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Laparoscopic approach in colonic diverticular disease: the state of the art

Sam C. Rossi, M.D., Roberto Bergamaschi, M.D., Ph.D., F.R.C.S., F.A.S.C.R.S, F.A.C.S

From the Department of Surgery, Allegheny General Hospital, Drexel University College of Medicine Clinical Campus, Pittsburgh, Pennsylvania

Address for proofs and reprint request: Roberto Bergamaschi, M.D., Ph.D. Director, Minimally Invasive Surgery Center Professor, University of Drexel Allegheny General Hospital, South Tower, 5th Floor, Room 578, 320 East North Avenue, Pittsburgh, Pennsylvania, 15212-4772, Fax +1 412 359 8646, RBergama@wpahs.org

Abstract

Although the literature on laparoscopic surgery for diverticulitis includes data on more than 1800 patients, the quality of the studies is not sufficient to draw definitive evidence-based conclusions. Non-randomized evidence suggests that laparoscopic resection for uncomplicated diverticulitis of the sigmoid may fair better than its conventional counterpart not only in short-term outcome (preservation of the abdominal wall, shorter disability), but also in the long run (decreased rates of late symptomatic small bowel obstruction). Five-year recurrence rates show that a laparoscopic or conventional access is unlikely to have an impact provided that the oral bowel end is anastomosed to the proximal rectum rather than to the distal sigmoid. Superiority of laparoscopy should be proven measuring health-related and patient-centered outcome measures rather than surrogate endpoints. Areas of concern include replacing conventional resection with laparoscopic suture, drainage and colostomy in patients with free perforation and peritonitis. The role of laparoscopic surgery should be limited to resection for uncomplicated diverticulitis of the sigmoid performed by adequate surgical expertise. Benefits can be expected with this procedure provided that indications for surgery are not influenced by the change of access, and postoperative complication rates remain within the range of traditional colorectal surgery.

Diverticular disease emerged in Western countries in the 20th century (1) and with an ageing population is now on the rise (2). The sigmoid colon is affected in 98% of patients admitted (3) and this is why this overview will address left-sided disease only. The focus will be on uncomplicated and complicated diverticulitis, whereas endoscopic findings of diverticulitis without clinical evidence of disease will not be addressed as these occur in about 0.8% of elective colonoscopies (4). An increasing number of surgeons are performing laparoscopic surgery for diverticular disease as witnessed by at least 51 articles published since 1992 (Table 1).

Table 1. 51 papers on laparoscopic surgery for diverticular disease from 1992

Evidence level (5)	# Papers	# Patients
Randomized with low rate of false positive or false negative errors	1	31
Randomized with high rate of false positive or false negative errors	0	0
Non-randomized concurrent cohort comparison	6	417
Non-randomized historical cohort comparison	10	208
Case series without controls	34	1877

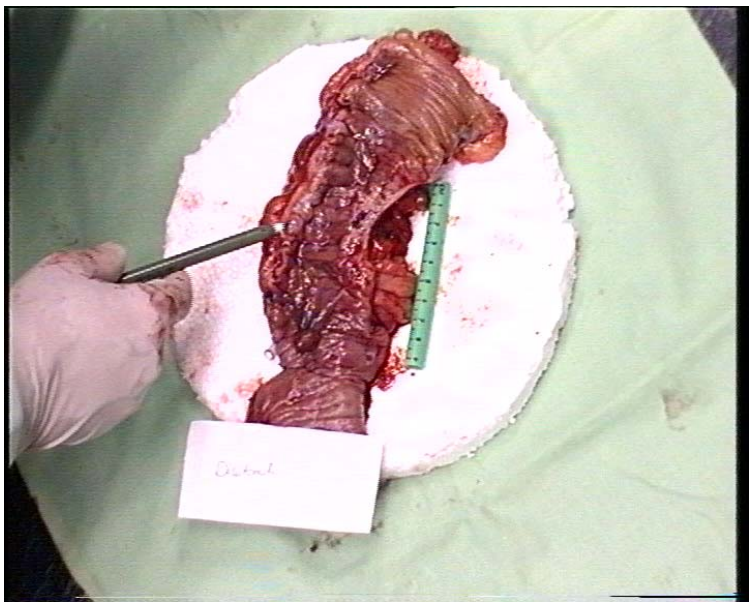
Most papers are series without controls, capable of suggesting feasibility. Comparison studies at times feature selection flaws and sample sizes based on surrogate outcome measures, and therefore beg the question of whether laparoscopic surgery should (or not) be considered as standard care. An attempt is made herein to give readers a concise insight of the evidence available in the English language literature. It does not intend to offer a comprehensive review of the topic; rather, it highlights some relevant issues, and then outlines what role laparoscopic surgery should play in diverticular disease.

Uncomplicated diverticulitis

Indications for surgery

Historical perspectives. Patients with uncomplicated diverticulitis of the sigmoid (UDS) have been treated conservatively until a policy revision in the mid 1950s recommended elective one-stage resection anastomosis for patients with repeated flares despite adequate medical treatment, or less than 50 years of age, or persisting deformity at contrast enema, or with urinary symptoms (5). A more exact definition of patient subgroups that would benefit of planned surgery was available in the 1970s. The natural history of all age patients admitted for UDS revealed that about half of these patients experienced mild and intermittent symptoms without need for further admissions throughout 1 to 16-year follow-up. During the same period, second admissions were required in the remaining 50% of the patients and of these 90% were re-hospitalized several times due to further attacks. However, after the second admission 10% of the patients had no further symptoms (6). In the subgroup patients younger than 40 years, 12% to 75% recover from their first acute episode without surgery (7-9). One third of the patients operated on during their first admission have UDS, but require resection because of persisting symptoms in spite of adequate medical treatment (7, 9). Follow-up data of unoperated young patients show that readmission within 27 months will be required in 55% of them and of these 25% will undergo emergency surgery for complicated disease (10). However, in a study from the mid 1990s all unoperated patients under the age of 50 (32%) requiring surgery during a 5-year to 9-year follow-up underwent elective resection without colostomy. Of the remaining 68% of the patients, 42% had mild symptoms attributable to diverticular disease (9).

Contemporary trends. Planned resection is currently advised to younger and older patients with UDS after first and second admission, respectively (11). This approach is not devoid of downsides: 10% of patients would undergo unnecessary surgery (6); 24% or 27% may have unchanged symptoms at a follow-up of 1-16 years (6) or 8-45 months (12) after surgery, respectively. Without laboring the obvious, this question was asked in the 1980s: ″Are we really operating on diverticulitis?″ (13). Absence of inflammatory changes in 24% of the specimens (13) is no much better than a 33% rate reported in the 1960s (14). It is likely that irritable bowel syndrome accounts for some failure rate after surgery, and elective surgery should be recommended with great caution in women with a history of abdominal pain not localized to the left lower quadrant (13). Individual case-by-case decision rather than a general rule in recommending elective resection to patients with UDS is therefore gaining support at least in Northern Europe. This is definitively a clear trend in the specific case of younger patients with UDS (15). Interestingly, a Markov model comparing the costs and outcomes of performing prophylactic resection after one, two, or three flares in a 60-year-old hypothetical cohorts concluded that performing resection after the third attack is cost saving, yielding more years of life and quality adjusted life years at a lower cost (16). Exception must be made in the case of immuno-compromised patients, hepatic-portal venous gas on ultrasound (17), marked thickening of the bowel wall with discrete intramural abscess (18), or painful stricture with no clinical obstruction (Figure 1).



Legend
Figure 1. Specimen from laparoscopic sigmoid resection showing marked thickening of the bowel wall causing painful benign stricture with no clinical obstruction.

Short-term outcome

Resumption of oral intake. Claims of earlier resumption of oral feeding after laparoscopic colorectal surgery have not been confirmed in randomized control trials (RCTs). On the other hand, the safety of early oral intake following open colorectal surgery has been proven in RCTs (19). A metaanalysis of 11 RCTs including 837 patients has shown that early oral intake significantly decreases anastomotic leak and infection rates, and length of stay as compared to nil by mouth (20). It has been suggested that surgeons should direct their attention less toward minimizing abdominal incisions and more toward decreasing use of postoperative narcotics (21).

Length of stay. A few non-randomized concurrent cohort comparisons have reported significantly shorter hospital stay after laparoscopic sigmoid resection for UDS as compared with their conventional counterpart (22-23). However, no difference in mean day of discharge was found in a prospective study comparing mini-laparotomy with laparoscopic-assisted surgery (24). A hospital stay of two days after open sigmoid resection may be achieved with the “fast-track” program (25). The duration of hospital stay decreases independent of laparoscopy, and much of the reported length of stay advantage is due more to excessive stay after open surgery rather than shortened stay following laparoscopy. Moreover, patients’ health literacy, preoperative counseling, discharge criteria, and social arrangements all play a certain role. It is about time for length of stay to be de-emphasized as its decrease by as much as one day reduces the total cost of care on average by 3% or less (26).

Complication rates. The definition of complication may vary and the use of one classification is desirable to ease comparisons. Most important is to run prospective institutional audits, though not before the choices on definition and classification have been made. The classification by Troidl et al (27) is to be recommended as it focuses on the correlation between surgical technique and patient morbidity (Table 2).

Table 2. Complications after Troidl classification

Stage	Complications
I	No morbidity
II	Surgical technical problem but no patient morbidity
III	No surgical technical problem but patient morbidity
IV	Surgical technical problem and patient morbidity
V	Morbidity related to coexisting illness
VI	Death

A prospective audit has shown that the 30-day morbidity for the first 240 patients undergoing laparoscopic colorectal surgery was not increased when compared with open surgical controls (28). The most significant variable affecting complication rates is surgical expertise. In spite of a consensus on incorporating the teaching of advanced laparoscopy into general surgery residency programs, the question remains how best to teach. The number of operations to be performed under close supervision of a scrubbed tutor should depend on the number of complications occurring during the learning phase.

Disability. When disability is defined as return to preoperative baseline activities (rather than return to work), laparoscopic colorectal surgery is associated with a shorter time to return to partial and full activities than was conventional surgery (29). However, health- related quality of life instruments have failed to provide convincing evidence on short-term benefits of laparoscopy.

Obese or elderly. Data from non-randomized concurrent cohort comparisons suggest that laparoscopic colectomy for UDS can be safely applied to elderly (30) or obese patients (31). However, increased rates of conversion should be expected in the latter case.

Surgical technique

Conversion. Conversion rates following laparoscopic resection of the sigmoid for UDS vary widely between studies depending on definition, patient selection, and which phase of the learning curve. The outcome of converted patients remains controversial although recent data show that conversion does not increase morbidity rates (32). A liberal attitude toward early conversion is important to contain morbidity rates. For instance, if the ureter cannot be identified, the case should be converted.

Exposure. This is achieved through four ports after having establishing a pneumoperitoneum. Nitrous oxide-based anesthesia should be avoided as it dilates the small intestine. A lateral to medial approach is preferred in the specific case of UDS as central vascular division is not necessary. The left ureter is identified. Mobilization of the splenic flexure should be done first to allow adequate exposure of the sigmoid colon. Mobilization will reduce tension on the colonic anastomosis.

Colorectal transection. Per-anum insertion of the shaft of the circular stapler prior to division of the non-mobilized rectum can be useful. If not, the bowel can erroneously be transected at a level higher than the recto-sigmoid junction leading to a too long stump. The bowel should be divided at 90º to its longitudinal axis with one cartridge only. Oblique transection may in fact contribute to the development of anastomotic stricture. Division of the mesorectum at the colorectal junction is current practice, although a randomized study has shown that sparing the inferior mesenteric artery decreases leak rates after sigmoid resection for UDS (33).

Location of Incision. Two types of incisions are used for access for the colorectal anastomosis after sigmoid resection: the left lower quadrant or horizontal suprapubic incision. There are several advantages for the horizontal suprapubic incision. The colorectal anastomosis can be performed under direct visualization without re-establishing pneumoperitoneum. Access and exposure deep into the pelvis is obtained much easier than the left lower quadrant incision. Finally, the suprapubic incision provides a better cosmetic look, especially in women.

Colorectal anastomosing. If intracorporeal hand-sewn purse string suture is your preference, curved needles are recommended, as the T-needle technique does not facilitate the procedure (34). If extracorporeal hand-sewn purse string suture through a horizontal suprapubic incision is your preference, you still have two options. Reposition -ing the oral bowel end back into the abdomen, wound closure, re-establishing pneumoperitoneum, and stapling is one choice. The alternative is stapling after mating anvil and shaft in an open fashion through the horizontal suprapubic incision (with no restoration of pneumoperitoneum). The former option requires you to move the telescope to a port placed in lower abdominal quadrant to obtain side view. Conversely, as long as the scope is kept at the umbilical site the resulting axial view will not allow you to rule out interposing tissue. The latter option contains operating time according to a small RCT (35). In both options, the use of a gun with a spike fixed to its shaft eliminates the need for spike retrieval. Prior to mating anvil and shaft remember to trace back the antimesenteric tenia of the oral bowel end to rule out mal-rotation.

Long-term outcome

Adhesions. Laparoscopic surgery may fare better not only in the short-term outcome, but also in the long run by decreasing rates of late symptomatic small bowel obstruction requiring surgery. This has been proven in Crohn's disease (36) and may be the case of UDS too.

Recurrence rates after surgery. Recurrent UDS after surgery is defined as left lower quadrant pain, fever and leucocytosis with consistent computer tomography and enema findings on admission and at six weeks, respectively. Although diverticular disease progresses after sigmoid resection, recurrence rates do not depend on the number of proximal diverticula (37) and decrease significantly when the distal line of resection is placed on the rectum (38). A trend toward an inadequate extent of proximal resection in laparoscopic surgery may reflect unwillingness to mobilize the splenic flexure, and/or difficulties in identifying noninflamed healthy-appearing descending colon of normal caliber (39). The latter can safely be retained. A laparoscopic or conventional access to sigmoid resection for UDS is unlikely to have an impact on recurrence rates provided that the oral bowel end is anastomosed to the proximal rectum rather than to the distal sigmoid. Anastomoses can be histologically classified as colosigmoid or colorectal based on the configuration of the muscle layers (taeniae coli) at the distal resection margin (40).

Complicated diverticulitis

Definition and classification. Complications include stricture (with or without obstruction) and perforation (abscess, fistula, peritonitis). Lower gastrointestinal bleeding will not be addressed herein, as it is associated with diverticulosis rather than diverticulitis. Several attempts have been made to classify complicated diverticulitis of the sigmoid (CDS) based on operative findings. The grading system devised by Hinchey et al. (41) (Table 3) has become widely used.

Table 3. Hinchey classification

Stage	
I	Pericolic abscess
IIa	Percutaneously drainable distant abscess
IIb	Complex abscess with fistula
III	Purulent peritonitis
IV	Fecal peritonitis

Stricture. The presence of a stricture should raise the question of whether the cause is carcinoma rather than CDS. Whenever the stricture cannot be traversed by a flexible scope the case should be managed as it were carcinoma. Conversely, in case of benign stricture with no large bowel obstruction laparoscopic resection should be offered (Figure 1). In the presence of complete (uncommon) or partial obstruction endoluminal stenting should be considered as it offers the advantage of being followed by elective resection (42).

Abscess. Hinchey I (pericolic abscess) or Hinchey IIa (distant abscess) patients should undergo computer tomography-guided percutaneous drainage followed by elective laparoscopic resection. This approach offers reduced length of stay without additional morbidity (43).

Fistula. Experience in laparoscopic surgery for internal fistulae (colovesical or colovaginal) is limited to five reports addressing overall 25 patients. The trade off appears to be a conversion rate of 30% with no reduction in length of stay for Hinchey IIb (complex abscess with fistula) patients (43).

Free perforation with peritonitis. The issue of whether it should be treated by resection with stoma or by non-resectional procedures (drainage and/or stoma) has been addressed by a review, which showed mortality rates of 12% and 28%, respectively (44). One RCT confirmed the superiority of resection over non-resectional surgery (suture, drainage and colostomy) in terms of rates of postoperative peritonitis (1/55 vs. 12/48; $p<0.001$). However, mortality rates did not differ significantly (24% vs.19%) (45). The Standard Task Force of The American Society of Colon and Rectal Surgeons recommends primary sigmoid resection with end colostomy regardless of whether patients have purulent (Hinchey III) or fecal (Hinchey IV) peritonitis (46). Indications for resection should not be influenced by the change of access. This is why replacing conventional resection with laparoscopic suture, drainage and colostomy is not the accepted standard of care (47). Some authors have advocated laparoscopic peritoneal lavage, and drainage without resection for generalized peritonitis resulting from perforated diverticulitis (48-49). This style of management was undertaken in individuals with purulent peritonitis, but without gross fecal peritonitis. Although this type of management was without any serious morbidity or mortality, this should not be the current standard of care for complicated diverticulitis.

Economics. There is little convincing data to demonstrate that laparoscopic colectomy for UDS is associated with a cost reduction. Presently, two studies reported a cost advantage (22, 48) while another study concluded that costs might actually be increased (23). Differences in cost limiting variables including operating room time, utilization of disposable instruments and overall length of stay may account for various conclusions. To be effective, cost analysis must take into account cost structure and all of its pertinent components including radiology, anesthesia, operating room, instrumentation and hospitalization costs. One

study provided a cost structure analysis of the entire hospitalization and concluded that laparoscopic colectomy for UDS is cost effective in selected patients provided that operating room time and equipment cost is contained (50).

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