Surg Endosc (1999) 13: 595–599

Surgical Endoscopy
Ultrasound and
Interventional Techniques

Laparoscopically assisted intestinal resection in 88 patients with Crohn's disease

J. Canin-Endres, B. Salky, F. Gattorno, M. Edye

Division of Laparoscopic Surgery, Department of Surgery, Mount Sinai Medical Center, 1010 Fifth Avenue, New York, NY 10029, USA

Received: 29 August 1998/Accepted: 22 January 1999

Abstract
Background: Experience with 94 resections in 88 patients with Crohn's disease using advanced laparoscopic techniques is reported. Records of patients who underwent intestinal resection for Crohn's disease between August, 1993 and November, 1998 were reviewed. Indications, operative findings, clinicopathologic, and postoperative data were recorded.
Methods: In this study, the mean age was 37 years (range, 16–70 years), and 55% of the participants were women. Indications for surgery included obstruction (64 cases), pain (22 cases), peritonitis (1 case) and abscess (1 case). Seventy patients underwent ileocolic resection, 28 of whom had a previous history of one or two ileocolic resections. Eight of these patients had additional procedures including tubal ligation (1), sigmoidectomy (1), cholecystectomy (3 cases), and enterectomy (3 cases). Small bowel resection (13 cases), right hemicolectomy (3 cases), subtotal colectomy (3 cases), anterior rectal resection (2 cases), and sigmoid resection (3 cases) were performed in the remaining patients. All but one procedure were completed laparoscopically with extracorporeal anastomosis. The average length of intestine resected was 33 cm (range, 10–92 cm). Forty-one patients had 58 fistulae between ileum, jejunum, mesentery, colon, abdominal wall, skin, or bladder. Mean blood loss was 168 ml (range, 30–800 ml) and mean operative time was 183 min (range, 96–400 min).
Results: More than 85% of the patients were tolerating a liquid diet on the first postoperative day. Average length of hospital stay was 4.2 days (range, 3–11 days). Complications included anastomotic leak necessitating reoperation, stricture requiring endoscopic dilation, hemorrhage treated expectantly, urinary tract infection, pulmonary embolus, line sepsis, and early postoperative intestinal obstruction (7 cases) requiring reoperation in three cases.
Conclusions: Experience with both advanced laparoscopic techniques and conventional surgery for inflammatory bowel disease allowed successful laparoscopic management of patients with complicated Crohn's disease.

Key words: Crohn's disease — Fistula — Inflammatory bowel disease — Laparoscopic surgery — Obstruction — Surgery

Laparoscopy for diagnosis [10, 18, 19] and intestinal resection [2, 3, 5–7, 9, 11, 13, 15, 16, 20, 21] in patients with Crohn's disease is gaining wide acceptance. Despite the technical demands of mobilizing the thickened, inflamed mesentery in the often immunosuppressed Crohn's patient, several of the cited studies have demonstrated the feasibility and safety of laparoscopic surgery for a wide variety of procedures. Early studies reported on patients with few of the complications associated with Crohn's disease known to haunt the most experienced surgeons. The presence of abscess, fistulae, and inflammatory mass have moved from the experienced laparoscopist's list of contraindications to that of indications. We report our experience with the surgical treatment of complicated and uncomplicated Crohn's disease using advanced laparoscopic techniques.

Materials and methods

Consecutive patients with Crohn's disease treated surgically by a single surgeon in a tertiary, university setting between August 1993 and November 1998 were prospectively entered into our divisional laparoscopic registry. Patients were assessed preoperatively with contrast radiography, endoscopy, and physical examination. Parameters reviewed included age, gender, previous surgery, indications for surgery, intraoperative findings, type of resection, blood loss, operative time, complications, and time to resolution of ileus and discharge.

Patients underwent standard bowel preparation and received perioperative broad spectrum antibiotics. All patients were treated with laparoscopic-assisted intestinal resection, defined as a procedure during which mobilization is performed laparoscopically and resection and anastomosis are performed extracorporeally via a small incision (4–10 cm).

Correspondence to: B. Salky

Table 1. Indication for surgery

Indication	No. of patients
Obstructive symptoms	64
Pain	22
Abscess	1
Peritonitis	1
Total	88

Table 2. Intraoperative findings and association with fistula

Intraoperative findings (No. of patients)	No. with fistula
Mass (17)	15
Abscess (11)	10
Fistula only (16)	16
No mass, abscess, or fistula (44)	
Total	41

All anastomoses were performed with stapling instruments. Conversion to laparotomy is defined as the making of an unplanned incision or inability to fully mobilize the diseased segment requiring a larger incision than necessary for simple exteriorization of the specimen. Resolution of ileus is felt to be indicated by the passage of flatus, the toleration of a regular diet, and the absence of abdominal distention or vomiting. Data are presented as the mean and range.

Results

Of the 88 patients studied, 87 underwent elective laparoscopic-assisted intestinal resection for Crohn's disease during the 63-month study period. Study participants were 48 women and 40 men with a mean age of 37 years (range, 16–70 years). The findings of mass, abscess, or fistulae on preoperative examinations did not alter the operative plan. Thirty-seven patients (42%) had undergone previous abdominal surgery, 28 (32%) of whom had previous laparotomy and intestinal resection for their disease. This was not considered a contraindication, nor did it contribute to conversion in any case. Previous treatment of these patients had involved access to the peritoneal cavity via an open technique. Forty patients (45%) were receiving chronic steroid therapy, and 12 were being treated with 6-mercaptopurine.

Most commonly, patients were being treated surgically for progressive obstructive symptoms. Chronic abdominal pain was the indication in almost all of the remaining patients (Table 1).

Intraoperatively, phlegmonous mass was seen in 17 patients, 15 of whom also had a fistula. Abscesses were encountered in 11 patients, 10 of whom also had a fistula. Sixteen patients had one or more fistula only (Table 2). In all, 41 patients had 58 fistulae. Thirty patients had a single fistula between the diseased segment and normal intestine, abdominal wall, or bladder (Table 3). Eleven patients were found to have multiple fistulae (Table 4).

Fistulae usually were transected with a laparoscopic stapling device. Alternatively, the fistula was transected sharply with repair of the normal viscus using intracorporeal suturing techniques.

Table 3. Distribution of single fistulas in 30 patients

Fistula location	No.
Cecal-psoas	1
Colovesical	3
Ileoabdominal side wall	4
Ileoanterior abdominal wall	3
Ileoappendix	1
Ileocolic	3
Ileocutaneous	2
Ileoileal	2
Ileojejunal	1
Ileoposterior abdominal wall	4
Ileosigmoid	4
Jejunosigmoid	1
Coloduodenal	1

Table 4. Location of multiple fistulae in 11 patients

Ileoileal, Ileoileal, Ileosigmoid
Ileomesenteric, Ileojejunal, Ileojejunal
Ileoileal, Ileoileal
Ileoileal, Ileoileal, Ileoileal
Ileoileal, Ileoabdominal wall
ileoileal, Ileocutaneous
Ileoileal, Ileosigmoid, Ileoabdominal wall
Ileoileal, Ileovesicle
Ileoileal, Ileovesicle, Ileoposterior abdominal wall
Ileoileal, Ileoabdominal side wall
Ileoileal, Ileotransverse, Ileosigmoid
Total No. of fistulae = 28

Technical considerations

Important technical considerations in dealing with fistulae include mobilization of the normal bowel first. In ileocolic resection, the hepatic flexure should be fully mobilized and capable of reaching the midline incision even though only a short segment of bowel will be removed. Dissection should remain close to the bowel during mobilization of the ascending colon, and care should be taken to keep the procedure superficial to the retroperitoneal fascial plane that contains the ureter and gonadal veins. Inability to know the location of the ureter in relation to the dissection is an indication for conversion. The mesenteric blood supply is divided intracorporeally if possible, although in Crohn's disease it usually is too thickened and divided extracorporeally. All bleeding points should be controlled immediately.

During mobilization of the terminal ileal attachments to the retroperitoneum, it is important to incise the peritoneum overlying the mesenteric fat and remain in the proper plane. If a loop of bowel is seen stuck to the mesentery, there likely is a fistula. In separating normal and diseased structures, dissection should remain close to the normal bowel wall. When a fistula is encountered, the proximal and distal normal bowel should be separated and easily visualized. This ensures that when the laparoscopic stapling instrument is placed across the fistula, the surgeon can be certain that the bowel lumen will not be narrowed. If the stapler seems to narrow the bowel, or in the event of a fistula to the bladder, the fistula is transected sharply and the hole is closed using intracorporeal suturing techniques. The last step is mobilizing the mass and enlarging the incision enough to encompass the mass and normal resection margins.

Table 5. Primary laparoscopic operations

Operation	*n*
Ileocolic resection	
Primary	42
Secondary	21
Tertiary	7
Small bowel resection	13
Anterior resection	2
Right hemicolectomy	3
Sigmoid colectomy	4
Subtotal colectomy	2
Total	94

Table 6. Additional laparoscopic operations in 8 patients

Primary operation	Additional operation
Ileocolic resection	Sigmoind resection
	Cholecystectomy (3)
	Small bowel resection (3)
	Tubal ligation
Small bowel resection	Ileostomy revision
	Bilateral salpingo-oophorectomy and stricturoplasty

Operative procedures are detailed in Table 5. Eight patients underwent additional laparoscopic operations (Table 6). Operative time averaged 183 min (range, 96–400 min), and blood loss was 168 ml (range, 30–800 ml). Only 1 of the 88 patients underwent conversion to formal laparotomy. This patient was the 60th consecutive patient in the study. He had a 10-year history of terminal ileitis and was undergoing laparoscopically assisted primary ileocolic resection. A large, inflammatory mass with multiple small intestinal loops adherent one to another and very thickened mesentery was present. Laparotomy was performed because of inability to progress with safe dissection in a timely fashion.

We routinely start clear fluids on postoperative day 1, and it was well tolerated in 85% of the patients. Return of bowel function occurred at an average of 3 days, with flatus and bowel movement occurring on day 3 (range, 1–7 days) and day 4 (range, 2–10 days), respectively. Patients on the average were consuming a regular diet by day 4 after surgery. Length of stay averaged 4.2 days (range, 3–10 days).

Complications occurred in 12 patients. Three patients, two of whom had previous resections for Crohn's disease, developed early postoperative small bowel obstruction requiring reoperation (Table 7).

Discussion

While the adequacy and long-term effects of laparoscopically assisted intestinal resection for cancer is being addressed by several prospective studies, this technique also is being recommended for benign disease. As a condition marked by inflammatory adhesions and masses, varying degrees of abdominal sepsis, and internal fistulae, Crohn's disease presents one of the more difficult disorders to embark on treating with the use of laparoscopic techniques [2, 3, 7, 9, 16, 21].

Before applying advanced laparoscopic techniques to this group of patients, the senior surgeon who operated on all the patients in our series (B.S.) had 20 years of experience operating on patients with Crohn's disease and had performed more than 4,000 laparoscopic procedures, including 317 laparoscopically assisted intestinal resections. This is evident in the similarity of the operative times and blood loss in the first half as compared with the second half of our study, implying passage of the our learning curve. This experience, in combination with the almost exclusive elective nature of the patients referred for laparoscopic resection, contributed to the low morbidity and conversion rate in our study. This did occur, though, despite the high incidence of reoperative cases and complicated disease in the majority of our patients. Only 44 patients (50%) in our study underwent primary resection and were free of fistula, mass, or abscess.

The main source of morbidity, and therefore increased postoperative hospitalization in our series, was early postoperative small bowel obstruction (SBO). There were seven SBO patients (8%), four of whom were treated nonoperatively and three who required operative intervention. Five patients had previous resections for Crohn's disease, and one had complex fistulae at the time of the original laparoscopic procedure. Dense adhesions were present in all cases requiring significant lysis so that the laparoscopic resection could be performed.

Only one patient in the postoperative obstructive group had an uncomplicated laparoscopic resection (without mass, fistula, abscess, or prior surgery). No one specific etiology for the postoperative SBO could be identified. Therefore, the presence of previous surgery, fistula, or phlegmon should alert the surgeon to the increased likelihood of SBO postoperatively. There were no "missed" skip lesions found as the cause of the postoperative SBO. Previous surgery (Crohn's resections) was not considered a contraindication to the laparoscopic procedure. One patient developed an anastomotic stricture postoperatively (6 months), which responded to colonoscopic dilatation.

The only infectious complications were a urinary tract infection and deep-line infection despite the chronicity of disease, usage of steroid and immunosuppressive therapy, and obstruction. There was a glaring lack of wound infections. This is in stark contrast to the expected 6% to 10% rate in open cases [8, 12]. In our earlier report of 102 laparoscopically assisted colon resections, two patients with right hemicolectomy had anastomotic leaks [5]. Since then, we have strictly avoided tension on the bowel and mesentery during extracorporeal resection and anastomosis and have observed no further occurrences.

Fistulae are part of Crohn's disease pathophysiology, and they should be expected at the time of laparoscopic resection, even if the preoperative evaluation does not demonstrate them [3, 17, 22]. We found that an inflammatory mass frequently is present with or without an abscess at the same time. The combination of mass and fistula portends a difficult dissection, and extra time in the operating room should be allotted. The easiest portion of the dissection should be performed first. In general, this means that noninflamed bowel should be mobilized before diseased segments are approached. Fistulae to normal bowel are divided

Table 7. Postoperative complications

Operation	Complication	Reoperative findings and treatment
2^0 Ileocolic resection	Early postoperative small bowel obstruction	Dense inflammatory reaction at anastomosis/ileotransverse colostomy
2^0 Ileocolic resection	Early postoperative small bowel obstruction	Dense adhesions/adhesiolysis
Ileostomy revision, small bowel resection	Early postoperative small bowel obstruction	Dense adhesions 1 ft proximal to ileostomy/small bowel resection
1^0 Ileocolic resection	Early postoperative small bowel obstruction	Nasogastric suction, hydration, bowel rest
1^0 Ileocolic resection, multiple fistulectomy	Early postoperative small bowel obstruction	Nasogastric suction, hydration, bowel rest
2^0 Ileocolic resection, fistulectomy	Early postoperative small bowel obstruction	Nasogastric suction, hydration, bowel rest
3^0 Ileocolic resection	Early postoperative small bowel obstruction	Nasogastric suction, hydration, bowel rest
1^0 Ileocolic resection	Anastomotic stricture	Endoscopic dilation
1^0 Ileocolic resection, fistulectomy	Postoperative hemorrhage	Expectant, no transfusion
1^0 Ileocolic resection, converted	Pulmonary embolus	Supportive, anticoagulation
Small bowel resection, fistulectomy	Pic-line sepsis	Removal of catheter
1^0 Ileocolic resection, fistulectomy	Urinary tract infection	Antibiotics

before mobilization of diseased segments. This greatly facilitates dissection of the diseased bowel.

Twelve patients had fistulization into the abdominal wall. In each case, there was tracking from a diseased segment of bowel to the abdominal wall. These patients presented clinically with an increase in abdominal pain consistent with the preoperative diagnosis of fistulization. Although the tracking did not reach the cutaneous level in most cases, the authors strongly believe that each one represented a fistulization process. These were not perforations (free or contained).

Incision size is determined by the presence or absence of an inflammatory mass, thickness of bowel and mesentery, extent of bowel mobilization, and abdominal wall thickness. This explains the incision range of 4 to 10 cm in this series. The attempt to bring large masses through small incisions is a mistake. In this study, length of hospital stay was the same even if the incision was extended to 10 cm.

At our institution, patients with acute and suppurative complications of Crohn's disease historically were referred for open resection, but these patterns are changing. Mass and fistulae, whether single or multiple, are routinely considered for laparoscopic-assisted resection by both the referring gastroenterologist and us. Frequently, however, these were intraoperative findings discovered during abdominal examination with the patient under anesthesia or during laparoscopy and dissection. Abscess was mainly found intraoperatively in our study, and in only one case was the indication for surgery. One or more fistulae were found in 47% of our patients. The finding of a fistula associated with a mass or abscess has been well described [1, 4, 17] and is supported by our operative findings. Routine identification of the ureter, minimal handling of the bowel, wide mobilization of the normal bowel to keep tension off the mesentery during extracorporeal resection, dissection close to the bowel wall, and prudent dissection in the plane between normal and diseased intestine with careful closure or transection of fistulae using stapling or suturing techniques allowed us to proceed safely with resection in patients who had complicated Crohn's disease.

Conversion rates reaching 30%, as reported in published series [2, 3, 6, 7, 9, 14, 21] are expected because of the complexity generated by the transmural inflammatory process at work in Crohn's disease. Contraindications to a laparoscopic approach have developed from these experiences, which have included multiple fistulae [9, 21], especially if they are associated with a fixed, inflammatory mass [2], previous operation or two previous operations for Crohn's disease [6, 21], diffuse ileal and colonic disease, and intra-abdominal abscess [9]. We no longer consider these to be contraindications in experienced hands, but do believe that these exclusion criteria are appropriate in a surgeon's early experience, because the learning curve for laparoscopic colorectal surgery is steep. Acute obstruction, generalized peritonitis, and toxic colitis remain our only absolute contraindications to a laparoscopic approach.

The theoretical and established benefits of laparoscopic surgery achieved in the current study are comparable to those reported in other studies of laparoscopically assisted resection in Crohn's disease [2, 3, 6, 20, 21]. As compared with open surgery, patients undergoing laparoscopic surgery seem to experience less pain, a quicker resolution of ileus, decreased length of postoperative hospitalization, and a better cosmetic result. Quicker return to normal activity and improved cosmetic result are especially important to the young patient population with this chronic disease. Whether recurrence of disease is effected by the use of laparoscopic techniques for resection in this group of patients is a question addressed in our prospective, randomized trial currently in process.

References

1. Ayuk P, Williams N, Scott NA, Nicholson DA, Irving MH (1996) Management of intra-abdominal abscesses in Crohn's disease. Ann R Coll Surg Engl 78: 5–10
2. Bauer JJ, Harris MT, Grumbach NM, Gorfine SR (1996) Laparoscopic-assisted intestinal resection for Crohn's disease: Which patients are good candidates? J Clin Gastroenterol 23: 44–46
3. Bemelman WA, van der Made WJ, Mulder EJ, Ringers J, van Hogezand RA (1997) Laparoscopic surgery in Crohn's disease. Neth J Med 50: S19–S22

4. Crohn BB, Ginzburg L, Oppenheimer GD (1984) Landmark article Oct 15, 1932. Regional ileitis: a pathological and clinical entity. JAMA 251: 73–79
5. Gellman L, Salky B, Edye M (1996) Laparoscopic assisted colectomy. Surg Endosc 10: 1041–1044
6. Jess P, Moller EH, Ladefoged K, Christiansen J (1996) Laparoscopic-assisted ileocecal resection for Crohn's disease: a preliminary study. Scand J Gastroenterol 31: 302–304
7. Joo JS, Agachan F, Wexner SD (1997) Laparoscopic surgery for lower gastrointestinal fistulas. Surg Endosc 11: 116–118
8. Kim NK, Senagore AJ, Luchtefeld MA, MacKeigan JM, Mazier WP, Belknap K, Chen SH (1997) Long-term outcome after ileocecal resection for Crohn's disease. Am Surg 63: 627–633
9. Ludwig KA, Milsom JW, Church JM, Fazio VW (1996) Preliminary experience with laparoscopic intestinal surgery for Crohn's disease. Am J Surg 171: 52–56
10. Miller GG, Blair GK, Murphy JJ (1996) Diagnostic laparoscopy in childhood Crohn's disease. J Pediatr Surg 31: 846–848
11. Milsom JW, Lavery IC, Bohm B, Fazio VW (1993) Laparoscopically assisted ileocolectomy in Crohn's disease. Surg Laparosc Endosc 3: 77–80
12. Nissan A, Zamir O, Spira RM, Seror D, Alweiss T, Beglaibter N, Eliakim R, Rachmilewitz D, Freund HR (1997) A more liberal approach to the surgical treatment of Crohn's disease. Am J Surg 174: 339–341
13. Oliveira L, Reissman P, Nogueras J, Wexner SD (1997) Laparoscopic creation of stomas. Surg Endosc 11: 19–23
14. Reissman P, Agachan F, Wexner SD (1996) Outcome of laparoscopic colorectal surgery in older patients. Am Surg 62: 1060–1063
15. Riessman P, Salky BA, Edye M, Wexner SD (1996) Laparoscopic surgery in Crohn's disease: indications and results. Surg Endosc 10: 1201–1204
16. Reissman P, Salky BA, Pfeifer J, Edye M, Jagelman DG, Wexner SD (1996) Laparoscopic surgery in the management of inflammatory bowel disease. Am J Surg 171: 47–51
17. Saint-Marc O, Tiret E, Vaillant JC, Frileux P, Parc R (1996) Surgical management of internal fistulas in Crohn's disease. J Am Coll Surg 183: 97–100
18. Salky B (1993) Diagnostic laparoscopy. Surg Laparosc Endosc 3: 132–134
19. Salky B, Bauer J, Gelernt I, Kreel I (1985) Laparoscopy for gastrointestinal diseases. Mt Sinai J Med 52: 228–232
20. Watanabe M, Ohgami M, Teramoto T, Hibi N, Kitajima M (1997) Laparoscopically assisted surgery for Crohn's disease. Nippon Geka Gakkai Zasshi 98: 418–423
21. Wu JS, Bimbaum EH, Kodner IJ, Fry RD, Read TE, Fleshman JW (1997) Laparoscopic-assisted ileocolic resections in patients with Crohn's disease: are abscesses, phlegmons, or recurrent disease contraindications? Surgery 122: 682–689
22. Young-Fadok TM, Wolff BG, Meagher A, Benn PL, Dozois RR (1997) Surgical management of ileosigmoid fistulas in Crohn's disease. Dis Colon Rectum 40: 558–561