Review Article

Laparoscopic colectomy in inflammatory bowel disease: indications and special considerations

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Contributions: (I) Conception and design: AB Parrish, P Fleshner; (II) Administrative support: None; (III) Provision of study materials or patients: None; (IV) Collection and assembly of data: None; (V) Data analysis and interpretation: None; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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Abstract: Laparoscopic surgery for inflammatory bowel disease (IBD) has lagged behind laparoscopic surgery for other colorectal pathologies due in part to challenges related to the fragility of tissues as well as patient factors such as malnourishment and immunosuppression. However, there remain significant advantages to laparoscopy for IBD such as decreased postoperative pain and narcotic requirements, quicker recovery, and decreased postoperative complications such as adhesions, infections, and female infertility. Given the unique challenges of IBD surgery, there are specific considerations that are important for any surgeon planning a laparoscopic colon resection for IBD. The workup and technical considerations that pertain to the most common laparoscopic operations performed for Crohn's disease and ulcerative colitis are discussed.

Keywords: Laparoscopy; colectomy; inflammatory bowel disease (IBD); ulcerative colitis (UC); Crohn's disease

Received: 31 December 2018; Accepted: 15 January 2019; Published: 27 January 2019.
doi: 10.21037/ales.2019.01.10
View this article at: http://dx.doi.org/10.21037/ales.2019.01.10

Introduction

Inflammatory bowel disease (IBD) is characterized by acute and chronic mucosal or transmural inflammation resulting in systemic manifestations and overall poor health. As many as 30% of patients with ulcerative colitis (UC) and 70% of patients with Crohn's disease (CD) require surgery within ten years of diagnosis (1,2). Surgery for IBD can be challenging due to a number of factors, including fragility of tissues, malnourished patients, steroid and biologic drug effects, preoperative opioid use and psychosocial factors not typically seen in the general colorectal population. Additionally, multiple operations are the rule in these patients, as many CD patients will require repeat surgery and surgery for UC is typically completed in two or three stages.

Due to its once perceived surgical complexity, laparoscopy was not originally used in IBD. The first report on laparoscopic colon resection for IBD was published in 1992 (3). These authors showed excellent results of laparoscopy when used for ileocolic resection but not for total abdominal colectomy (TAC) with restorative proctocolectomy (RPC), likely due to the more complex nature of the procedure. Improvements in technology as well as increased surgical experience have allowed laparoscopy to become the standard of care approach for both CD and UC (4-6). However, there remains a steep learning curve due to technical challenges of laparoscopic colectomy as well as anatomic considerations of the pelvis (7).

Advantages of laparoscopy

There is a plethora of evidence describing the advantages of laparoscopic surgery in IBD, particularly with regards to the management of postoperative pain and complications. As many IBD patients are chronically dependent on

narcotics, postoperative pain control is often challenging. Laparoscopic techniques minimize incisional pain, leading to less narcotic usage and faster postoperative recovery (8,9). Additionally, a transversus abdominus plane (TAP) block can be performed under direct visualization, which has been shown to be superior to both ultrasound-guided TAP block and local infiltration alone (10,11).

Limiting adhesion formation during surgery is also of paramount importance for the IBD patient, not only due to the high likelihood of repeat operations but also to avoid compromising fertility in women. Laparoscopic colectomy results in significantly fewer adhesions, making subsequent operations safer and quicker (12). Fertility may also be positively influenced with laparoscopy, as a number of studies have shown increased fertility rates after ileal pouch surgery when performed laparoscopically versus open, presumably due to decreased adhesion formation involving the fallopian tubes (13,14). Furthermore, in this predominately young population, having smaller and cosmetically superior incisions when using laparoscopy is another important consideration (15).

An additional benefit of laparoscopic surgery in IBD is the potential to decrease postoperative complications, reduce hospital length of stay and lower overall cost of care. Compared to open surgery, laparoscopy may be associated with fewer postoperative complications including incisional hernias, superficial wound infections, and intra-abdominal abscesses (5,16). Many studies have shown faster postoperative recovery after laparoscopic ileocolic resection, laparoscopic ileal pouch surgery for UC, as well as laparoscopic total colectomy (4-6,17-21). Multiple studies in CD have shown that despite increased cost for the surgical materials used and longer operative times for laparoscopic versus open ileocolic resection, overall costs are lower in the laparoscopic groups due mostly to shorter hospital stays (9,18,22). There is less evidence regarding decreased cost for laparoscopic surgery for UC, however some have suggested comparable costs for laparoscopic *vs.* open IPAA and decreased cost for laparoscopic *vs.* open TAC (23,24).

Special considerations

Crohn's disease

While there are definite advantages to performing laparoscopic surgery in patients with IBD in general, there are some unique challenges that need to be considered in CD. In this disease, the inflammation is transmural resulting in a small bowel mesentery which is often thick and friable. For example, blood vessels in this area may tear with significant blunt dissection when separating the mesentery from the retroperitoneum. Laparoscopic vessel-sealers such as the Ligasure® device (Medtronic, Minneapolis, MN, USA) may not adequately seal these vessels without complete isolation, and even then, may not result in adequate hemostasis. Alternatives for mesenteric vascular ligation include laparoscopic mobilization with exteriorization of the specimen and direct suture ligation of mesenteric vessels.

The fistulizing and stricturing phenotypes in CD may also complicate laparoscopic surgery. Conversion to open surgery in order to safely take down enterocutaneous or enteroenteral fistulas is common yet prudent. Stricturing disease may be difficult to evaluate laparoscopically due to the lack of external bowel wall findings. Thus, it is important to palpate the bowel to identify areas of stricture not visible externally. Adjunctive studies can also be performed preoperatively to evaluate the small bowel and guide if a laparoscopic approach is feasible and where to place the incisions. These studies include magnetic resonance enterography (MRE), computed tomographic enterography (CTE), ultrasound (US), or double balloon endoscopy with tattooing of strictured segments. Although preoperative imaging such as small bowel follow-through with barium has historically been used to detect strictures, fistulas, or abscesses prior to operation, its accuracy is poor. A retrospective review found that barium imaging compared with intraoperative assessment of strictures with a Foley balloon catheter underestimated the stricture burden in one third of patients (25). Conversely, MRE is more likely to overestimate stricture burden with a sensitivity of 96% and specificity of only 67% (26). Regarding complicated disease such as presence of abscesses and fistulas, accuracy of MRE is above 88% for both. CTE and US have also demonstrated high accuracy for detecting complicated disease, however CTE exposes the patient to ionizing radiation and US is operator dependent and may miss disease deep in the pelvis or beneath bowel loops (26,27).

Despite the widespread use of biologic medication use in CD, redo surgery is still very common. Laparoscopic redo-ileocolic resections have been shown to be safe and feasible, however there is a higher likelihood of needing open conversion secondary to previous adhesions and difficulty identifying anatomy (28). It is important to note the locations of any prior incisions as obtaining

pneumoperitoneum may be difficult. Alternative access techniques may be required such as insufflation and port placement at Palmer's point or use of the Hasson technique. Severe adhesions at the site of the previous ileocolic anastomosis may cause the recurrent disease segment to be plastered to the right pelvic sidewall making laparoscopic mobilization difficult. Regardless, starting the procedure laparoscopically may provide the surgeon with a "road map" of where adhesions are located and help guide further incisions, which may be smaller and optimally located for exteriorization of the specimen.

UC

While UC is not typically characterized by the mesenteric manifestations associated with CD, the surgery of UC remains challenging because patients are often malnourished, anemic, and immunosuppressed at the time of surgery. Accordingly, a three-stage procedure for UC is often the preferred surgical approach. The first stage is performing a TAC with end ileostomy. When the patient has fully recovered from the disease and the surgical procedure, completion proctectomy with ileal pouch-anal anastomosis (IPAA) and diverting ileostomy (DI) is performed. The final stage is closure of the DI. As previously discussed, decreased adhesion formation is a major benefit of performing the first two procedures laparoscopically due to the near certainty that one will re-enter the abdomen during these staged resections.

The preoperative workup prior to a planned RPC with IPAA should exclude as best as possible the presence of CD and assess for any dysplasia or colorectal cancer. This usually includes a full colonoscopy as well as small bowel imaging. In an ideal situation, such as a patient that is not on steroids or anti-TNF agents, is not obese, and without major medical comorbidities or signs of severe acute colitis, one could consider a one- or two-stage approach. Otherwise, a three-stage approach will allow for decreased incidence of postoperative morbidity by avoiding a proctectomy and IPAA in the acute period. It will also decrease the length of the initial surgery, which takes longer laparoscopically than open and allows the proctectomy and IPAA to be performed in an elective setting (29,30).

For the first stage of the procedure, preparation with preoperative stoma marking and education is essential for the patient to be both independent in caring for their stoma and for choosing the optimal placement site to reduce stoma related complications (31,32). Discussion with the patient regarding possible conversion to open via various incisions such as a Pfannenstiel or midline incision is important to avoid postoperative surprises. Obese patients may also make laparoscopic TAC challenging, as increased body mass index has been shown to be associated with an increased rate of conversion (33).

The TAC has traditionally been performed with either five trocars or a hand-assisted approach (4,6,30,34). Others have used a single incision with various access port devices and traditional laparoscopic instruments (35). We prefer to perform this surgery with three trocars, which can be done safely and in an expeditious manner. A 12 mm trocar is placed in the right lower quadrant at the planned ileostomy site, which is also used for the diverting loop ileostomy during the second stage of the procedure. This site will accommodate a large bipolar energy device used for dividing mesentery and a stapler. A 5 mm trocar is placed suprapubically and a 10 mm 30-degree camera is placed peri-umbilically. These sites can facilitate an entire TAC and leave the patient with only two visible incisions after the ileostomy is brought up. During mobilization and division of the right colon mesentery, the ileocolic vessels are ideally spared, and assessment is made with possible division of the vessels at the time of the second stage procedure to gain additional mesenteric length for the IPAA if needed for optimal reach. Prior to complete mobilization and vascular ligation of the left colon, a mesenteric window is made at the rectosigmoid junction to accommodate a laparoscopic stapler and the colon is divided. Care must be taken to not leave excessive colon in the abdomen that could contribute to persistent colitis of the stump. The colon is then completely mobilized and removed through the ileostomy site.

During the second stage, the ileostomy is initially taken down to assess for adequate length of the IPAA. Typically, adhesions are minimal if the first stage is performed laparoscopically. A GelPOINT® Mini (Applied Medical, Rancho Santa Margarita, CA, USA) is placed at the ileostomy site, and three trocars are inserted here to accommodate a camera, an energy device, and conventional bowel grasper to perform the laparoscopic proctectomy. An additional trocar may also be placed in the previous suprapubic site for retraction of the uterus if necessary. Specific considerations during this stage include performing a complete mobilization of the base of the small bowel mesentery to release the superior mesenteric vessels from their attachments near the fourth portion of the duodenum and inferior border of the pancreas. This can be accomplished using a Ligasure® device with blunt and sharp dissection. Additional maneuvers

that may provide extra length for the pouch include step ladder incisions along the small bowel mesentery as well as ligation of mesenteric vessels after temporary clamping and confirming adequate perfusion to the pouch. During the low pelvic portion of the proctectomy, reaching the pelvic floor may be difficult laparoscopically, especially in a male pelvis. Therefore, we use a GelPOINT® Path transanal access platform (Applied Medical, Rancho Santa Margarita, CA, USA) to perform a transanal proctectomy with close rectal dissection to "rendezvous" with the abdominal dissection. This can be performed simultaneously with a second team to expedite the process. The abdominal insufflation helps to provide counter-tension during the transanal dissection, and the laparoscopic surgeon may help the dissection by manually retracting the rectum. After the rectum is completely detached from its pelvic attachments, known as the "dismount", the specimen can usually be removed transanally which obviates the need to enlarge the ileostomy site. After an ileal pouch is fashioned through the ileostomy site, care must be taken to laparoscopically bring the pouch down to the anus without twisting the mesentery or damaging the pouch. A handsewn anastomosis with mucosectomy is the authors' preferred approach if the pouch is able to reach to the dentate line without tension. It is critical to grasp the dorsal aspect of the pouch transanally to allow for maximum reach to perform the anastomosis. Another anastomotic option is using a double purse-string technique to perform a circular stapled anastomosis if a stapled anastomosis is preferred or if reach to the dentate line is not adequate (36-38). It is important to note that for IBD without malignancy or dysplasia, a total mesorectal excision is not necessary and a close rectal dissection may be preferred to avoid injury to the pelvic nerves. Furthermore, staying close to the rectum may decrease injury to ureters, vagina, prostate, or urethra.

Since the advent of the totally laparoscopic approach for the IPAA, assessing pouch reach to the pelvic floor may be challenging. One method is to pull the terminal ileum through the ileostomy site and assess the maximal length of the pouch. This may be performed by confirming that the apex of the pouch reaches the base of the penis in men or vaginal introitus in women. If acceptable reach is not attained, making a Pfannenstiel incision and assessing J pouch length may be helpful.

Conclusions

Acceptance of laparoscopy for IBD surgery as the standard of care lagged behind laparoscopic colon resections for other indications due to the added technical difficulty of the resections. Minimally invasive surgery for IBD however not only decreases postoperative pain and quickens time to recovery, but also decreases postoperative infections and adhesions. Minimizing adhesions in this population is particularly important given the frequency of re-operation, the use of staged procedures, and the preservation of fertility in young women.

The surgical technology and techniques used for colectomies and especially proctectomies are advancing rapidly. Already, the DaVinci Xi robot (Intuitive, Sunnyvale, CA, USA) has been shown to have comparable results to laparoscopy for colorectal resections for IBD (39). As the cost decreases and familiarity with robotic surgery increases, this approach may become more prevalent. It is important for surgeons to stay current with new techniques in this exciting time in order to continue striving towards improved patient outcomes.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the Guest Editors (Michael J Stamos and Mehraneh Dorna Jafari) for the series "Laparoscopic Colon Surgery" published in *Annals of Laparoscopic and Endoscopic Surgery*. The article has undergone external peer review.

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/ales.2019.01.10). The series "Laparoscopic Colon Surgery" was commissioned by the editorial office without any funding or sponsorship. The authors have no other conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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doi: 10.21037/ales.2019.01.10
Cite this article as: Parrish AB, Zaghiyan K, Fleshner P. Laparoscopic colectomy in inflammatory bowel disease: indications and special considerations. Ann Laparosc Endosc Surg 2019;4:13.

