Review Article

The advantage of intracorporeal techniques

Matthew T. Brady

Department of Surgery, University of California, Irvine, CA, USA

Correspondence to: Matthew T. Brady, MD. Department of Surgery, University of California, Irvine 333 City Blvd. West, Suite 850, Orange, CA 92868, USA. Email: Matthew.t.brady.md@gmail.com.

Abstract: Laparoscopic intracorporeal anastomotic techniques can confer benefits to patients undergoing laparoscopic colon and rectal surgery. Despite the widespread use of minimally invasive colon and rectal surgery, laparoscopic intracorporeal anastomosis is rarely employed. Intracorporeal anastomotic construction mirrors extracorporeal techniques but requires experience with advanced laparoscopic skills, including intracorporeal stapling and suturing.

Keywords: Laparoscopic; minimally invasive surgery; colon and rectal surgery; intracorporeal anastomosis

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Introduction

Since its inception there has been an increasing usage of minimally invasive surgery for the treatment of colon and rectal disease. In that time, multiple studies have demonstrated the safety and efficacy of laparoscopic surgery for the treatment of both benign and malignant diseases of the colon and rectum (1-6). Advantages of minimally invasive surgery have been described as decreased postoperative pain and narcotic usage, decreased postoperative hospital length of stay, early return of bowel function, quicker return to work, and decreased postoperative incisional hernia risk. In this article we will look beyond the benefits of laparoscopic surgery and focus specifically on the benefits of performing an intracorporeal anastomosis during colon surgery.

In bariatric surgery, a significant leap was made in the transition from open roux-en-y gastric bypass to the development of laparoscopic roux-en-y gastric bypass. Laparoscopic gastric bypass surgery requires multiple intracorporeal anastomoses in each procedure. Surgeons faced a significant learning curve to make that adjustment but today laparoscopic approach to gastric bypass, and other bariatric surgeries, remains the standard of care (7,8). Laparoscopic colon and rectal surgery has also made significant advances since its early days. Interestingly though, descriptions of laparoscopic colon and rectal surgery still include incisions large enough to facilitate specimen extraction, use of a hand port for hand-assisted techniques, or a combination of laparoscopic and open approach for pelvic dissection. Furthermore, many surgeons continue to preferentially perform extracorporeal anastomoses to reestablish intestinal continuity after segmental resection.

Advocates for extracorporeal anastomosis argue that the need for a specimen extraction site makes this technique equivalent to intracorporeal anastomosis. Unfortunately, the choice to perform an extracorporeal anastomosis may negatively influence the chosen site of extraction. Given midline incisions have increased rates of incisional hernia development, the ability to select an extraction site other than the midline can confer significant long term benefits to the patient (9-11).

The wide array of techniques and operative approaches that live under the minimally invasive umbrella of colon and rectal surgery may also influence the benefits of laparoscopic surgery when compared with open techniques. Factors such as postoperative length of stay, postoperative ileus rates, and patient satisfaction, may all be influenced by opting for a totally laparoscopic technique with intracorporeal anastomosis. In this article we will discuss the intracorporeal anastomosis, its operative technique, its benefits, and how the technique compares to extracorporeal anastomosis with

regards to postoperative outcomes.

Anastomotic leak

Anastomotic construction is a critical part of every colon and rectal operation. Anastomotic leak rates in colon and rectal surgery are described as ranging from 1–3% for ileocolic anastomoses, and has been described as upwards of 20% for colorectal anastomoses (12,13). Anastomotic leak is a fretted complication and this is likely a contributing factor for the reluctance of surgeons to make the jump to performing an intracorporeal anastomosis in laparoscopic colorectal surgery. Many can be wary of altering such a critical aspect of a surgery. Also, with the ability to position an extraction incision in location to facilitate extracorporeal anastomosis, most surgeons do not see a need for making such a transition.

Anastomotic leak rates have been shown to be comparable between open and laparoscopic surgery for colon resections (1,3). Though, as described above, in many of these trials, an extracorporeal anastomosis is performed. Multiple smaller scale investigations have been performed to investigate intracorporeal *vs.* extracorporeal anastomoses and have demonstrated no difference in leak rates between the two techniques (14-17). Lack of comfortability with intracorporeal stapling and suturing may be a factor in the relatively slow adoption of intracorporeal anastomotic technique. It appears that in experienced hands intracorporeal anastomotic construction has, at a minimum, equivalent leak rates compared with open techniques.

Incisional hernia

Incisional hernias after colectomy are a common complication, which cause significant morbidity and whose risk can be mitigated by opting for a totally laparoscopic technique with an intracorporeal anastomosis. Incisional hernia rates after laparoscopic colorectal surgery can occur in upwards of 30% of patients (10). It is clear that laparoscopic approach alone does not mitigate the risk of incisional hernia. The lack in reduction is possibly due to surgeons opting to perform an extracorporeal anastomosis through a midline incision. Unfortunately, unless a colorectal anastomosis is planned, midline incisions are often used for extraction and extracorporeal anastomosis. Midline incisions are associated with significantly increased rates of incisional hernia when compared with incisions made off the midline, especially Pfannenstiel incisions (9-11). Currently, a prospective multi-institutional study is ongoing to investigate incisional hernia rates following intracorporeal and extra-corporeal anastomosis in laparoscopic and robotic right colectomies.

Natural orifice extractions, either transvaginal or transanal, also can help minimize incisional hernia risk. These extractions allow for a totally laparoscopic approach with no incisions aside from port site incisions. In appropriately selected patients these natural orifice extractions have been shown to be safe and feasible (18,19). The ability to forgo a midline incision, or any incision for that matter, is a significant advantage to any patient undergoing laparoscopic colectomy.

Overall, it appears a major factor in avoiding a postoperative incisional hernia is a critical evaluation of the extraction site, should one be necessary. Intracorporeal anastomosis allows for all extraction sites to be considered while extracorporeal anastomosis limits the choice of extraction site to one that facilitates exposure of the operative field.

Surgical site infections

Surgical site are a commonly addressed problem in colon and rectal surgery and significant work has been aimed at reducing surgical site infections following colectomy. Habits aimed at preserving sterility during clean contaminated cases such as the use of closing trays, changing gloves and gowns after anastomotic construction, and use of incisional wound protectors, have been associated with decreased rates of surgical site infections. Currently, intracorporeal and extracorporeal anastomoses appear to have equivalent rates of both deep and superficial surgical site infections (14,15,20).

Postoperative recovery

Laparoscopic colorectal resections have been associated with improved short term patient outcomes. Rates of postoperative ileus, time to flatus, and time to hospital discharge have all been shown to improve with laparoscopic approaches. Intracorporeal anastomosis is associated with improvements beyond what is achieved by extracorporeal anastomosis in some series. Both single and multi-institution experiences have shown improved rates of return of bowel function and shortened hospital length of stay when comparing intracorporeal and extracorporeal anastomosis, however this is not seen in all series investigating the two techniques (20,21).

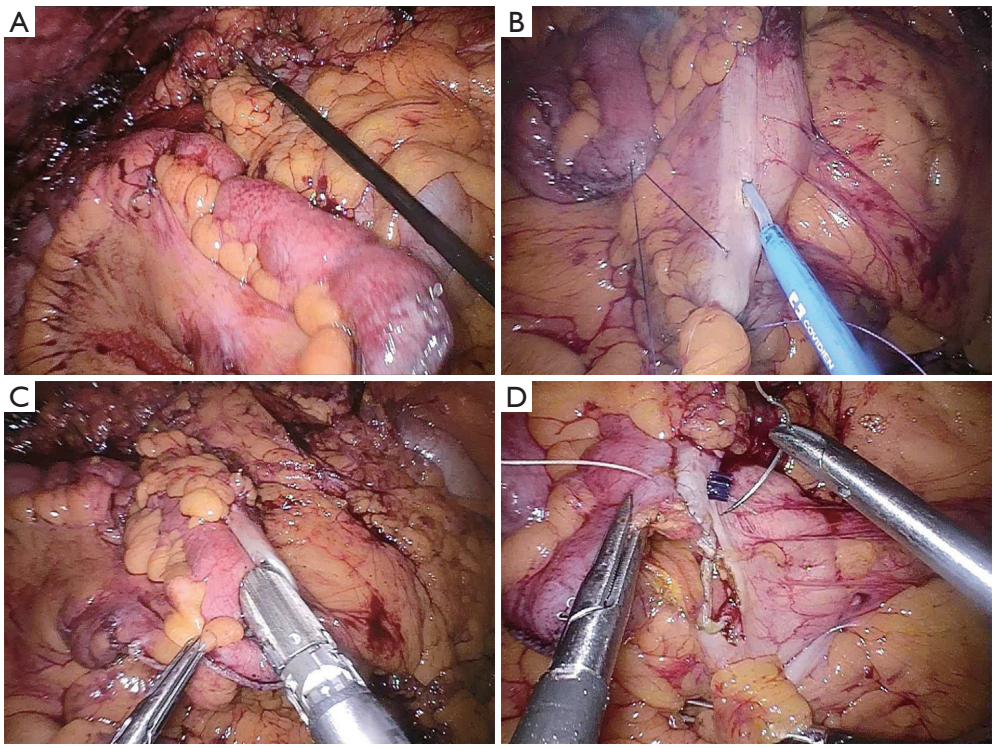

Figure 1 The mesentery is divided with a laparoscopic energy device and the bowel is divided a stapler. (A) The ileum and transverse colon are aligned in an iso-peristaltic fashion; (B) a suture is placed at the anastomosis for traction and enterotomies are made with the energy device along the anti-mesenteric edge of the bowel; (C) a linear stapler is used to create a common channel; (D) the common enterotomy is closed with intracorporeal suturing.

Techniques

Iso-peristaltic ileocolic anastomosis (Figure 1)

Prior to creating the anastomosis the mesentery is divided at the planned transection location, ileum and colon are divided with linear staplers, and the specimen is set aside for later extraction. The limbs of the ileum and colon are aligned in an isoperistaltic configuration in the right upper quadrant. A traction suture is placed through the antimesenteric taenia of the colon and the staple line of the ileum. Next, enterotomies are created using an energy device and a laparosocpic linear stapler is employed to create the common channel of the anastomosis. The common enterotomy is typically sutured closed using an absorbable suture as to not narrow the efferent limb of the anastomosis.

Anti-peristaltic ileocolic anastomosis (Figure 2)

When performing an anti-peristaltic anastomosis the ileum and colon are oriented so that both staple lines align. The traction suture is placed through each staple line towards the antimesenteric edge of the bowel Next, enterotomies are created adjacent to the traction suture and again a linear stapler is used to create the common channel of the anastomosis. The common enterotomy can then be closed with either a linear stapler or laparoscopic suturing, whichever the surgeons preference.

Conclusions

Intracorporeal anastomotic construction is a technique which is safe and confers multiple benefits to patients undergoing colon and rectal surgery. The actual anastomotic construction techniques mirror the techniques used for extracorporeal anastomosis, though experience with advanced laparoscopy is needed. The largest benefits are likely the decreased risk of postoperative incisional hernia and a prospective multicenter trial investigating this outcome is underway.

Figure 2 The steps for mesenteric and bowel division are identical as the iso-peristaltic technique, though additional mobilization of the transverse colon is often required. The ileum and transverse colon are aligned in an anti-peristaltic fashion. (A) A suture is again placed for traction and enterotomies are created along the anti-mesenteric aspect of each limb of bowel; (B) next, a linear stapler is used to create the common channel; (C) a linear stapler is again used to close the common enterotomy, this can be performed by suturing as well.

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Footnote

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