Evaluation of intra Corporeal Versus Extra Corporeal Anastomosis Technique after Laparoscopic right Hemicolectomy

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Abstract

Background: Following bowel resection, an anastomosis between the small and large intestines must be formed. Extracorporeal anastomosis[1] is the gold standard for restoring continuity; however, intracorporeal (IC) anastomosis is also a viable approach that has been shown in several observational studies to be as safe and efficient. **Objective**: To clear the feasibility and morbidity of either intra corporeal or extra corporeal anastomosis technique. **Conclusion**: Intracorporeal anastomosis (IC) anastomosis after laparoscopic hemicolectomy is time saving and less morbid technique compared to extracorporeal anastomosis. **Study design:** Descriptive study. **Setting:** The study was conducted the family planning unit at the outpatient clinic of Zagazig university hospitals. **Study subjects:** A convenient sample included 310 women.

Keywords: Anastomoses, Laparoscopic Right hemicolectomy, intra corporeal anastomosis, Extra corporeal anastomosis.

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Introduction:

Laparoscopic techniques were adopted by general surgeons in the 1980s with subsequent adaptation to colorectal surgery in 1991. The robotic approach was introduced to colorectal surgery in 2002 and upgrades in the robotic platform have resulted in recent increased adoption by colorectal surgeons. Subsequent studies demonstrated improved minimally invasive short-term post-operative outcomes, with earlier return of bowel function, lower analgesia requirements, and shorter hospital length of stay[2].

Data have also demonstrated equivalent oncologic outcomes for patients undergoing minimally invasive colon resections when compared to open operations, with associated decreased post-operative morbidity. Recent data suggest a continued increase in the use of minimally invasive approaches for both benign and malignant colorectal disease[3].

How to restore intestinal continuity and create a superior anastomosis is still a topic for consideration in colorectal surgery. Minimizing infectious complications that include anastomotic leak, post-operative abscess, and surgical site infection is imperative, but decreasing time to discharge and quicker recovery are also key outcomes. Minimally invasive ileocolic and colorectal anastomoses may be performed using intracorporeal (or total laparoscopic/robotic) or extracorporeal (or laparoscopic/robot assisted) techniques[3].

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❖ **High-Risk Anastomoses:**

There are certain clinical situations in which clinical judgment precludes the creation of an anastomosis, even with proximal diversion. Some factors to consider include severe malnutrition, significant immunosuppression, gross or longstanding fecal contamination, and the risk of developing hemodynamic instability in the postoperative period[4].**)**

Types of anastomoses:

❖ **Extracorporeal anastomosis:**

➢ **Anastomotic technique:**

For right colectomies, after complete mobilization of the terminal ileum, cecum, ascending colon, and proximal transverse colon, an upper midline incision is typically made by extending the camera port incision along the midline. The mobilized ileum and colon are then exteriorized after insertion of a wound protector. The terminal ileum and transverse colon are divided, and the ileocolic anastomosis is constructed using standard open techniques[5].

Some surgeons divide the mesentery and vessels laparoscopically or robotically prior to exteriorizing the specimen and performing the extracorporeal resection and anastomosis. Others perform various parts of mesenteric and vessel division after exteriorization of the specimen and prior to bowel division and anastomosis[2].

After division of the specimen, an extracorporeal functional end-to-end anastomosis is then constructed by aligning the ileum and transverse colon in an isoperistaltic or antiperistaltic fashion. Enterotomies are made in the ileum and transverse colon and a linear cutter 55- or 75-mm blue load stapler is placed through these enterotomies and fired, thereby creating the anastomosis. The common enterotomy is then sutured closed in one or two layers[6].

For left colectomies, after adequate mobilization, the upper rectum is transected using a laparoscopic or robotic linear stapler. A midline or Pfannenstiel incision is made, a wound protector is placed, and the proximal end of the transected bowel is delivered through the incision thereby exteriorizing the specimen still attached to the proximal colon. The specimen is resected using standard open techniques[3].

A circular stapler anvil is secured in the open proximal end of soft and pliable colon using a purse string suture. The colon with secured anvil is returned to the abdominal cavity and pneumoperitoneum reinstituted. The circular stapler is passed through the anus and coupled with the anvil in the proximal colon, and an end-to-end anastomosis is created either laparoscopically or with robotic assistance. The anastomosis is tested for leaks using endoscopic air insufflation with saline in the pelvis, and endoscopic viability is confirmed on both sides of the anastomosis[5].

Extracorporeal anastomosis advantages:

Exteriorization of the proximal and distal bowel with attached specimen allows for visual inspection and palpation prior to resection and anastomosis. Some surgeons think this may help confirm healthy, soft, and viable bowel for anastomosis and confirm appropriate margins for oncologic resections. Since bowel transection and creation of the anastomosis occur outside of the abdominal cavity, there is potentially a decrease in risk of intra-abdominal spillage of colonic contents related to this technique[2].

- **Extracorporeal anastomosis disadvantages:**

Because of the need to exteriorize the bowel for resection and anastomosis, significantly more bowel and mesentery must be mobilized to obtain adequate reach for specimen resection and anastomosis, especially in obese patients with thick abdominal walls. For right hemicolectomies, exteriorizing the transverse colon to a small midline specimen extraction site may be challenging with risk of traction injury to bowel or mesentery. This may result in serosal injuries, mesenteric bleeding, and devascularization of bowel and mesentery that may potentially contribute to post-operative ileus[3].

The transverse colon may not reach the extraction site easily and the midline incision may need to be lengthened to accommodate. Many surgeons use a midline extraction site for extracorporeal right colectomies. The midline site is associated with a significantly higher rate of incisional hernias (8–12%) with associated long-term morbidity when compared to off-midline extraction sites[6]. **(Harr et al., 2016)**

- **Intracorporeal anastomosis:**

- **Anastomotic technique:**

For right colectomies, an intracorporeal ileo-transverse colon anastomosis is typically chosen for the minimally invasive approach. Following complete medial-to-lateral and lateral-to medial mobilization of the ileum and colon, and complete detachment of the mesentery from the retroperitoneum, the terminal ileum and transverse colon are transected using a laparoscopic or robotic linear cutter stapler. The ileum and transverse colon are aligned in either an isoperistaltic or antiperistaltic configuration[3].

A seromuscular stay suture is placed between the ileum and transverse colon and retracted toward the right side of the abdomen to optimize alignment. A colotomy and enterotomy are then made and the linear cutter stapler is placed and fired, creating the anastomosis. The common enterotomy is then closed with suture in one or two layers. The specimen is then removed via a small Pfannenstiel or other off-midline incision[5].

When describing anastomotic options for left colectomies, it may be best to refer to intracorporeal technique rather than intracorporeal anastomosis. The anastomosis is “intracorporeal” for both intracorporeal and extracorporeal techniques. However, the entire operation prior to specimen extraction that includes mobilization of the mesentery and division of the vessels, upper rectum, and proximal colon, followed by placement of the anvil and creation of the anastomosis, are all done within the abdomen for the intracorporeal technique[7].

In contrast, the extracorporeal left colectomy technique is characterized by resection of the specimen and placement of the anvil after delivering the specimen through the extraction site incision using standard open techniques[6]. The intracorporeal technique starts with medial-to-lateral mobilization of the descending and sigmoid colon and mesentery. The inferior mesenteric vessels are divided after identification of the left ureter. Lateral-to-medial mobilization of the left colon is followed by intracorporeal division of the upper rectum using a laparoscopic or robotic linear cutter stapler. The mesentery is divided from point of transection of the inferior mesenteric artery to the proposed point of transection of the descending colon[2].

A long 3–4 cm colotomy is made distal, and a small 6 mm colotomy made proximal to the proposed point of transection of the descending colon. The anvil is introduced into the abdomen through either a Pfannenstiel or other off-midline extraction site incision. After re-establishing pneumoperitoneum, the anvil is passed through the long colotomy and then the shaft of the anvil routed through the small colotomy proximal to the proposed point of transection[7].

The descending colon is then divided with a linear cutter stapler after confirming viability with immunofluorescence. The long colotomy, now on the specimen side, is closed with a running suture and the specimen is set aside until completion of the anastomosis. The circular stapler is passed through the anus and coupled with the anvil on the descending colon and a side-of-colon to end-of-rectum anastomosis is created. The specimen is then removed through a Pfannenstiel or other off-midline extraction site incision[7].

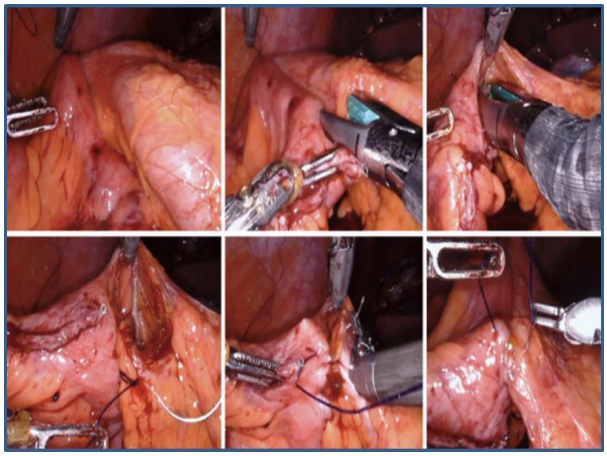

Figure (1**):** Intracorporeal anastomosis for right hemicolectomy. The ileum and colon are aligned with a seromuscular stitch and retracted toward the right side of the abdomen (upper left). A colotomy and enterotomy are then made and the linear cutter stapler is placed (upper middle) and fired, creating the anastomosis (upper right). The common enterotomy (lower left) is then closed with suture in two layers (lower middle and right) [2]

Intracorporeal anastomosis advantages:

Since the colon does not require exteriorization for resection and anastomosis, there is no need to mobilize bowel that will remain in-situ, and no traction is required to deliver the specimen to a small extraction site incision. This decreases the risk for mesenteric bleeding, serosal injuries, and the occasional need to extend the extraction site incision. This may result in less ileus. The length of the IA extraction site incision is not influenced by whether the colon will reach, and the size of the IA extraction site incision is limited only by the size of the specimen[3].

For some morbidly obese patients, the only minimally invasive option may be an IA approach because of the degree of difficulty related to thick and short mesentery reaching an extracorporeal extraction site in a thick abdominal wall. Because the specimen may be removed at any off-midline location, the risk for incisional hernia and subsequent related long-term morbidity from complex hernia mesh repair is reduced[7].

Since the specimen transection is intracorporeal, palpation of the bowel prior to transection is not performed and some consider this a disadvantage. Additionally, the enterotomies for the anastomosis are created intra-abdominally, exposing the peritoneum to potential intraluminal contamination. However, no studies have demonstrated an increase in surgical site infections and sepsis when comparing IA and EA groups[3].

Complications of Anastomosis and Its Prevention

❖ **Consequences:**

An anastomotic leak is a life-threatening complication, with a mortality of 10–15% range from sepsis to progressive multiorgan failure. Timely diagnosis and treatment prior to the onset of advanced organ dysfunction has been emphasized as a key factor in reducing the mortality rate. Patients with a more indolent course may also succumb to venous thromboembolic or other indirect complications owing to the prolonged hospital stay, limited mobility, and persistent inflammatory state[8].

Patients with an anastomotic leak often require difficult and complicated reoperations in a hostile local environment, with considerable additional postoperative morbidity. Functional, physical, emotional, and psychological recovery is often measured in months or even years[9].

Prolonged wound care, ventral hernias, bowel obstructions, and management challenges associated with gastrointestinal adaptation to the altered anatomy may continue to be active considerations for long periods of time. Local sepsis may lead to an impaired functional result, especially after low pelvic anastomosis. There is an adverse relationship between anastomotic leak and local recurrence after rectal resection for cancer[10].

❖ **Prevention:**

Because we still do not know why most anastomotic leaks occur, we remain limited in our ability to prevent many of them. Even among high-volume surgeons, significant differences may be found in leak rates, suggesting that technical and/or judgment errors play a causative role in at least some leaks. Many patient- and surgeon-specific factors have been associated with an increased risk of an anastomotic leak[8].

Many patient factors are simply markers for a sicker patient, and it is unclear which of the factors on this list are simply associated with a leak versus actually contributory. Attention to controlling certain risk factors (smoking, nutritional status, weight) does seem worthwhile. Several reviews documented an impressive reduction in anastomotic complications when the anastomosis was tested during surgery[11].

When a leak is identified intraoperatively, the options are to (1) repair a well-defined defect, (2) redo the anastomosis, (3) proximally divert, or (4) a combination of the above. Specific bacteria that produce locally destructive collagenolytic proteins (e.g., certain Enterococcus, Pseudomonas, or Serratia species) may be an important cause of anastomotic leaks, and perioperative suppression/eradication of these microbes may reduce leak rates[4].

❖ **Treatment:**

Factors to be considered when deciding on the appropriate management for a patient with an anastomotic leak include patient-specific factors (hemodynamic derangement, physiologic reserve, nutritional status, comorbid complications, initial surgical indications/goals) and features of the leak (location, size of the defect, presence of concomitant tissue ischemia) [8].

Perhaps the most useful classification in outlining the principles of management is early versus late presentation. Patients with an early leak classically present in the first week after surgery with signs and symptoms of peritonitis, organ dysfunction associated with sepsis, and hemodynamic instability. In this clinical setting, prompt return to the operating room is required. Patients with an anastomotic leak often present with signs and symptoms that lead the surgeon astray and suggest other serious postoperative complications (e.g., pulmonary embolism, myocardial ischemia) [11].

If the diagnosis is established in the first few days after the initial surgery, most patients will require operative exploration. Intravenous antibiotics and close observation may be appropriate in a few highly selected patients with small, contained leaks that otherwise appear reasonably well (low colorectal anastomosis, especially if they have a proximal diversion). At re-operative surgery, the peritoneal cavity is thoroughly irrigated, and appropriate cultures obtained[4].

In general, patients with a small bowel to small bowel or ileocolic anastomosis are best treated with resection and repeat anastomosis. Patients who are hemodynamically unstable may be treated with an ileostomy and end- loop stoma, where the distal end is brought out through the same aperture as the ileostomy. Anastomosis with proximal loop ileostomy is another alternative to address this situation where primary anastomosis alone is deemed unwise[9].

When a colocolic anastomosis breaks down, dividing the anastomosis and creating an end colostomy is usually the most appropriate option. Resection with anastomosis and proximal loop ileostomy is an option for hemodynamically stable patients. Leak after low anterior resection creates challenging management decisions. If the anastomosis is divided and a colostomy created, then subsequent attempts for another low pelvic

anastomosis may be a formidable endeavor[10].

When there is no ischemia and the leak is relatively small and contained, loop ileostomy and drainage of the anastomosis are usually most appropriate. In stable patients with major disruptions, resection with anastomosis and proximal diversion may also be an option. The management of anastomotic leaks diagnosed beyond the first week to 10 days post-operatively usually differs in many important regards from its earlier counterpart[4].

Careful imaging including a CT scan of the abdomen and pelvis with intravenous and enteric (including rectal) contrast is typically the key to diagnosis and treatment planning. Re-operative surgery is usually unnecessary and will quite often make things worse. Most patients with late presentations are most often best managed by patience, antibiotics, and percutaneous drainage. Both covered stents and vacuum-assisted devices have been used with anecdotal success. Nutritional support, using the enteral route whenever possible, should not be neglected[8].

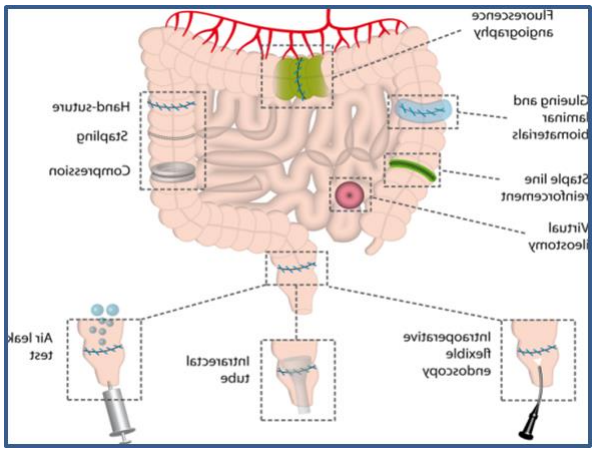

Figure (2): Innovative approaches for induction of anastomotic healing[12].

Conclusion:

We concluded that Intracorporeal anastomosis (IC) anastomosis after laparoscopic hemicolectomy is time saving and less morbid technique compared to extracorporeal anastomosis.

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