Comparison of early results between intracorporeal and extracorporeal anastomosis in laparoscopic colectomy

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Abstract

Introduction: The study aim was to compare the operative time, estimated blood loss, number of harvested lymph nodes, intraoperative and postoperative complications, as well as postoperative recovery between intracorporeal and extracorporeal anastomosis in laparoscopic colectomy for colon cancer.

Patients and methods: Retrospective study, case series. From 01/2021 to 8/2022, there were 99 patients, divided into two groups: intracorporeal anastomosis (n = 47) and extracorporeal anastomosis (n = 52). The operative time, estimated blood loss, number of harvested lymph nodes, intraoperative and postoperative complications were compared between two groups.

Results: The intracorporeal anastomosis group has significantly shorter time to first flatus (2,7 ± 0,9 vs 3,1 ± 1,0 days; p=0,04) and shorter postoperative hospital stay (6,6 ± 1,7 vs 7,3 ± 1,1 days; p=0,03). Intracorporeal anastomosis can be performed within a comparable time frame as extracorporeal anastomosis, although the anastomosis forming time is significantly longer (33,4 ± 6,0 vs 24,2 ± 6,1 minutes; p<0,001). There was no difference in estimated blood loss, number of harvested lymph nodes, time to first stool, as well as overall complications between two groups.

Conclusions: Intracorporeal anastomosis in laparoscopic colectomy is safe, feasible, and does not increase the overall complications and the overall operative time. Intracorporeal anastomosis significantly decreases the time to first flatus, the postoperative hospital length of stay, but prolong the anastomosis forming time as compared to extracorporeal anastomosis.

Keywords: intracorporeal anastomosis, extracorporeal anastomosis, laparoscopic colectomy.

Introduction

Surgery is the mainstay of colon cancer treatment, with the role of minimally invasive surgery becoming more and more important. In the world, forming anastomosis completely inside the abdominal cavity during laparoscopic colectomy has been proven to be safe, effective; does not lengthen the operating time, does not increase the rate of intraoperative and postoperative complications; but also reduce the bowel movement resumption time, shorten the hospital stay [1-8]. In Vietnam, author Dao Van Cam [9] in 2019 initially reported that the implementation of intracorporeal colonic anastomosis is safe and feasible. However, the author has not made a comparison with intracorporeal anastomosis. Therefore, we conducted this study to compare the surgical results, the degree of postoperative recovery, as well as the rate of complications between the two techniques, thereby evaluating the practical applicability of intracorporeal anastomosis.

Patients and methods

To compare between the two techniques, we retrospectively reviewed patients whom underwent laparoscopic left or right colectomy, performed by the research team, at University Medical Center of Ho Chi Minh city from January 2021 to August 2022. The study subjects were divided into 2 groups: group A included patients whom were performed extracorporeal functional end-to-end anastomosis with straight staplers, group B included patients who were performed intracorporeal overlap anastomosis with straight staplers. The study sample did not include patients whom underwent colectomy of two or more segments; patients whose anastomosis were not performed (made an colostomy); patients with hand sewn anastomosis or stapler anastomosis using techniques that were different from the listed ones; patients with histopathological results after surgery that were not colon cancer.

All the patient information is collected from the hospital's electronic medical record. In addition to the basic information such as age, gender, body mass index, comorbidities, etc.; the information that was of interest to the research team to conduct a comparison between the two groups included: preoperative blood hemoglobin and albumin concentration, stage of colon cancer (TNM classification), operative time, anastomosis forming time, intraoperative blood loss, number of haversted lymph nodes, intraoperative complications, time to first flatus, time to first stool, postoperative hospital stay, postoperative complications. The collected data were processed using SPSS 25 software to compare between the two groups.

Results

From 01/2021 to 08/2022, 99 patients who met the criteria were selected, in which 47 cases were performed intracorporeal anastomosis and 52 cases were performed extracorporeal anastomosis.

Patient characteristics

The mean age of the study population was 60.2 years (28-87 years old). The male:female ratio is 1.02:1. The mean BMI was 22.0 ± 3.2 kg/m2. There are 49.5% of cases with comorbidities such as: hypertension, diabetes, cardiovascular disease which required anticoagulants or antiplatelet drugs (chronic ischemic heart disease, atrial fibrillation, etc.). There are no cases of asthma, chronic obstructive pulmonary disease, cirrhosis, end-stage renal failure or Cushing's syndrome have been reported. The majority of patients indicated for colectomy were at stage II and III of colon cancer (66.7% and 27.3%); only 1.0% of patients with stage I colon cancer found in the top layers of large polyps which cannot be removed through endoscopic surgery and 5,1% of patients with complicated stage IV conlon cancer (partial bowel obstruction, gastrointestinal bleeding...) were indicated for

colectomy. The mean preoperative hemoglobin concentration was 120.0 ± 19.6 mg/L, the mean preoperative blood albumin concentration was 38.7 ± 4.2 g/L. Generally, the clinical and laboratory characteristics of patients in both groups are similar in gender, age, comorbidities, colon cancer stage, preoperative hemoglobin and blood albumin levels. However, the intracorporeal anastomosis group had a significantly higher BMI than the extracorporeal anastomosis group (22.7 ± 3.4 vs 21.3 ± 2.9 kg/m^2, p=0.001).

Surgery results

There were 52 cases of laparoscopic right colectomy and 47 cases of laparoscopic left colectomy, equally divided into two groups: intracorporeal and extracorporeal anastomosis. In all extracorporeal anastomosis cases, the specimens were extracted and the anastomosis was formed through the periumbilical midline incision. In 47 cases of intracorporeal anastomosis, there were 21 cases (41.7%) in which the specimens were extracted through the suprapubic transverse incision, the remaining 26 cases (58.3%) through the periumbilical midline incision. The mean operating time in the study was 140 minutes, with a median of 130 minutes (70-250 minutes). The average anastomosis forming time was 28.6 minutes, with the median time of 30 minutes (15-45 minutes). The average number of harvested mesenteric lymph nodes was 16.2 nodes, with the median of 13 nodes (2-53 nodes). The mean blood loss was 34.75 ml, the median was 20 ml (10-350 ml). There were 4 cases (4.0%) with large amount of intraoperative blood loss (>100ml), and no cases of visceral or vascular injury during colectomy. Overall, there were no statistically significant differences in operative time, number of harvested lymph nodes, intraoperative blood loss, and intraoperative complication rates between the two groups. However, the anastomosis forming time was significantly longer in the intracorporeal anastomosis group (Table 1).

Table 1. Surgery results

Characteristics		All n=99 (%)	Intra-corporeal anastomosis n=47 (%)	Extra-corporeal anastomosis n=52 (%)	p
Laparoscopic colectomy	Right	52 (52.5%)	21 (44.7%)	31 (59.6%)	0.1
	Left	47 (47.5%)	26 (55.3%)	21 (40.4%)	
Operating time (mins)		140.0 ± 39.0 (70-250)	145.0 ± 40.0 (100-240)	135.3 ± 44.2 (70-250)	0.2
Anastomosis forming time (mins)		30.0 ± 7.5 (15-45)	33.4 ± 6.0 (30-45)	24.2 ± 6.1 (15-30)	<0.001
Intraoperative complications		4 (4.0%)	1 (2.1%)	3 (5.8%)	0.6
Number of harvested lymph nodes		16.2 ± 11.0 (2-53)	16.3 ± 11.1 (2-47)	16.2 ± 11.0 (2-53)	0.9
Intraoperative blood loss (ml)		20.0 ± 36.8 (10-350)	33.6 ± 17.4 (10-100)	35.8 ± 48.3 (10-350)	0.8

Postoperative complications

The overall complication rate after surgery was 6.1% (6 cases), equally divided into two groups (3 cases per group). The recorded complications included: 3 cases of anastomosis bleeding (3.0%), 1 case of anastomosis leak (1.0%), 1 case of partial bowel obstruction due to adhesions (1.0%), and 1 case of respiratory failure due to pneumonia (1.0%). In which, there was 1 case of mortality due to the complications of pneumonia.

All 3 cases of anastomosis bleeding (2 cases in intracorporeal anastomosis group and 1 case in extracorporeal anastomosis group) had small amount of blood in stool (<50ml a day) and responded well to internal treatment without the need for endoscopic hemostasis or surgery. There was 1 case of laparoscopic left colectomy with intracorporeal anastomosis, who has anastomosis leak on the third day after surgery. In this case, the anastomosis was surgically removed, and colostomy was constructed. We recorded 1 case of partial bowel obstruction due to adhesions in the extracorporeal anastomosis group. This case responded well to internal treatment and did not require surgical intervention. The case of respiratory failure due to pneumonia occurred in the extracorporeal anastomosis group. This case was transferred to the intensive care unit for treatment in the third day after surgery and has passed away on the 7th postoperative day. Thus, the rate of serious complications (Clavien Dindo grade 3 or higher) was 2.0% (2 cases), evenly distributed for both groups.

In addition, complications such as infectious fluid collection, residual abscess, anastomosis fistula, intra-abdominal bleeding, or surgical site-related complications (incisional infection, incisional bleeding, abdominal wall dehiscence) were not recorded. Because the follow-up time is not long enough, within the scope of this study, we have not investigated late complications such as incisional hernia, anastomosis stricture... and have not investigated the cancer treatment results.

Postoperative recovery

The postoperative hospital stay and time to first flatus is significantly shorter in the intracorporeal anastomosis group. The time to first stool, however, is not significantly different between two groups (table 2).

Table 2. Postoperative recovery

Characteristics	All n=99 (%)	Intra-corporeal anastomosis n=47 (%)	Extra-corporeal anastomosis n=52 (%)	p
Time to first flatus (days)	2,9 ± 1,0 (1-6)	2,7 ± 0,9 (1-5)	3,1 ± 1,0 (1-6)	0,04
Time to first stool (days)	4,5 ± 1,3 (1-11)	4,3 ± 1,6 (1-11)	4,6 ± 1,0 (2-7)	0,2
Postoperative hospital stay (days)	7,0 ± 1,5 (4-12)	6,6 ± 1,7 (4-12)	7,3 ± 1,1 (5-10)	0,03

Discussion

Regarding techniques, according to Milone, performing an intracorporeal colonic anastomosis brings many advantages [1]. Firstly, the colon segment bearing the tumor does not need to be mobilized too much to bring out of the abdominal cavity. Instead, it only need to be mobilized enough to form the anastomosis. Second, forming the anastomosis inside the abdominal cavity reduces the contact of fecal material with the incision, reducing the rate of incisional infection. Third, the formation of adhesions inside the abdominal cavity can be limited, by minimizing the touch of the surgeon's hand to the peritoneal cavity. Fourth, the length of the incision can be reduced by up to 50% because the incision now only serves to extract the specimens and no longer serves the anastomosis forming phase. Thereby reducing the postoperative level of pain and complications related to the incision. Finally, performing the anastomosis inside the abdominal cavity under the laparoscopic view eliminates the risk of anastomosis twisting caused by the limited field of view that the extracorporeal anastomosis technique brings.

However, Milone also reported that performing an intracorporeal anastomosis still has certain difficulties [1]. First, the patient colon must be mechanical prepared before surgery to limit the fecal material contamination to the abdominal cavity. Second, the surgeon must have extensive experience in laparoscopic surgery to perform endoscopic sutures. Third, the prolonged duration of anastomosis forming may increase the complications associated with the anastomosis. Fourth, the cost of surgery may increase, because performing an overlap anastomosis requires more staplers than a functional end-to-end anastomosis. Through this study, our research team also recognized another difficulty. For small-sized colon lesions, manual palpation when performing an extracorporeal anastomosis can help confirm the lesion location and the safe resection margin. This is very difficult to achieve when manipulating through the laparoscopic tools and often requires the help of an intraoperative colonoscopy, thereby prolonging the operating time.

Regarding surgery time, previous studies have shown mixed results. While the study of Vignali and Achilli [3] showed significantly longer operative time in the intracorporeal anastomosis group. However, studies by Allaix [4], Widmar [2], and Malczak [5] did not record this. In our study, the operating time was not statistically significant between the two groups (145.0 ± 40.0 minutes versus 135.3 ± 44.2 minutes), however the time of anastomosis forming in the intracorporeal anastomosis group was significantly longer (33.4 ± 6.0 minutes versus 24.2 ± 6.1, $p<0.001$). When forming an anastomosis inside the abdominal cavity, the length of the colon segment need to mobilized is substantially shorter, thereby shortening the time in the resection phase. Because the resection phase is shortened, compensating for the anastomosis forming phase, in general, the operating time was not significantly different between the two groups. Moreover, the anastomosis forming time and the operating time depends a lot on the experience of the surgeons. Since these are the first cases of our research team performing intracorporeal anastomosis, these time periods can be further shortened once we reach a plateau on the training curve.

Regarding the recovery after surgery, there have been many studies around the world showing that, performing an intracorporeal anastomosis reduces the bowel movement resumption time and post operative hospital stay. A 2018 meta-analysis by Marco Milone of 1862 cases of right laparoscopic right colectomy showed that performing an anastomosis inside the abdominal cavity significantly reduced the time to first flatus, time to first stool, and postoperative hospital stay

compared to extracorporeal anastomosis. This result has been consistently demonstrated in the randomized controlled clinical trials of Vignali [10], Allaix [4], Widmar [2], and Malczak [5]. Even more, Vignali's study also showed that the rate of ileus after surgery in the intracorporeal anastomosis group was significantly lower (3.3% versus 23.3%)3. The manual manipulation and pulling on the colon and the mesentery when bringing the colon out of the abdominal cavity may lead to postoperative ileus. Furthermore, the longer incision needed to form an anastomosis outside the abdominal cavity also contributes to an increased level of postoperative pain, an increase in the need for analgesics, and an increase in paralytic ileus due to side effects of the medication and limitation of movement of the patients.

Because the follow-up time is not long enough, we can only evaluate and compare the early results of the two techniques of intracorporeal and extracorporeal anastomosis. Long-term outcomes for postoperative complications, cancer treatment outcomes, postoperative pain, and surgical costs were not evaluated in the scope of this study. In addition, forming an anastomosis inside the abdominal cavity can be more beneficial. As the suprapubic transverse incision used to extract the specimens instead of the periumbilical midline one, can theoretically reduce the rate of incisional complications and reduce the postoperative pain level. Thereby, in the future, there is a need for randomized controlled clinical trials that fully explore the above factors, to accurately evaluate and compare the benefits and disadvantages of this two techniques.

Conclusions

The application of intracorporeal anastomosis in laparoscopic surgery for colon cancer is safe, feasible, does not increase the rate of complications, does not increase the operating time. Forming colonic anastomosis inside the abdominal cavity shortens the time of first flatus, shortens the postoperative hospital stay, but prolongs the anastomosis forming time compared to the extracorporeal anastomosis.

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