Intracorporeal versus extracorporeal anastomosis in laparoscopic right hemicolectomy – single center experience

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Abstract

Introduction: *Nowadays laparoscopic right hemicolectomy is widely accepted as the standard of care for benign and malignant colon disease. There are wide variations among laparoscopic techniques. One of the most discussed topics is the ileocolic anastomosis. There are two different techniques: intracorporeal anastomosis (IA) and extracorporeal anastomosis (EA).*

Aim: *To compare short-term outcomes of performing intracorporeal versus extracorporeal anastomosis in laparoscopic right hemicolectomy.*

Material and methods: *A retrospective chart review was performed of 92 consecutive patients who underwent laparoscopic right hemicolectomy, with either an IA or EA, from January 2013 to December 2016.*

Results: *Eighty-five patients were included in the analysis. There were 53 males and 32 females with a mean age of 67.1 ±13.2 years. Mean body mass index (BMI) was 27.7 ±4.8 kg/m^2. An intracorporeal anastomosis was performed in 51 patients, while an extracorporeal anastomosis was performed in 34. The duration of operations was significantly longer when intracorporeal anastomosis was performed, taking 154 ±58 min compared to 95 ±34 min ($p < 0.001$), in the extracorporeal group. No mortality was observed in the IA group. The postoperative mortality in the EA group was 8.8% ($p = 0.060$). The rate of reoperation in the intracorporeal anastomosis group was 7.8%, whereas in the extracorporeal anastomosis group it was 14.7% ($p = 0.474$). Length of hospital stay in the IA group was shorter in comparison to the EA group (5.3 ±3.7 vs. 11.2 ±19.8 days, $p = 0.022$).*

Conclusions: *Our results are encouraging to consider the intracorporeal approach as the better way to fashion the anastomosis after laparoscopic right hemicolectomy.*

Key words: *intracorporeal, extracorporeal, anastomosis, laparoscopic right hemicolectomy, complications, outcomes.*

Introduction

Since the introduction of mini-invasive colorectal surgery many large randomized trials have demonstrated oncologically equivalent outcomes for laparoscopic and open colon resection [1]. Nowadays laparoscopic right hemicolectomy is widely accepted as the standard of care for benign and malignant colon disease [2, 3]. Laparoscopy has many benefits including improved recovery, reduced analgesia needs, lower rate of surgical site infection and shorter hospital stay. There are wide variations among laparoscopic techniques, including the approach for bowel mobilization, anastomosis, mesentery defect closure, etc. One of the most discussed topics is the ileocolic anastomosis. There are two different techniques: intracorporeal anastomosis (IA) and extracorporeal anastomosis (EA). The advantages of IA

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are avoidance of traction of the mesentery during extraction of the bowel, the free choice of the site of specimen extraction, full visualization of every step of creation of the anastomosis, and easy management in obese patients. The disadvantages of IA are: necessity for advanced laparoscopic suturing skills, longer learning curve, and possible bowel contaminations. It is currently debated which of the two anastomosis technique is more suitable.

Aim

The purpose of this study was to compare short-term outcomes of performing intracorporeal versus extracorporeal anastomosis in laparoscopic right hemicolectomy

Material and methods

A retrospective chart review was performed of 92 consecutive patients who underwent laparoscopic right hemicolectomy, with either an IA or EA from January 2013 to December 2016. All of the procedures were performed by experienced surgical oncologists and the type of anastomosis was the surgeon's preference. Patients who underwent conversion to open surgery during the procedure or had radiotherapy prior to surgery were excluded. The demographic data were collected, including information related to sex, age, body mass index (BMI), American Society of Anesthesiologists (ASA) score, diagnostic group (benign/malignant), and the following previous abdominal procedures: appendectomy, cholecystectomy, hernia, hysterectomy, sigmoidectomy and others. Surgical variables included operative time, postoperative mortality and rates of complications, conversion, reoperation, length of hospital stay and readmission within 30 days. Major complications included anastomotic leak and bleeding. Other complications included: wound infection, ileus and bowel obstruction, dehiscence, and strangulation of inguinal hernia. Pathologic data included the following: anatomopathological diagnosis, TNM stage and number of removed lymph nodes (isolated and positive).

Surgical technique

The patient was placed in a supine position, the surgeon was standing on the left, assistant next to the surgeon on his left side. Three trocars were used: one 10 mm, a 5 cm to the left of the umbilicus, one 12 mm in the left epigastric region, and one 5 mm in the midline 5 cm over the pubis. The ileocolic and right branch of media colic vessels were identified and dissected after application of hemostatic clips or a bipolar sealing device. The colon was mobilized systematically via a medial-to-lateral approach. A side-to-side isoperistalsis anastomosis was created with a 60 mm endostapler and the enterotomy was closed with continuous double layer suture. The mesenteric defect was closed by two Z sutures. The specimen was extracted through a Pfannenstiel incision. The incision for specimen extraction was protected in all cases with an isolation device. Endobags were not used. In the case of EA the position of the patient and operational team was the same. Four trocars were used: the first 10 mm in the umbilicus, the second 10 mm in the left epigastric region, a 5 mm trocar in the left iliac fossa, a 5 mm trocar in the right iliac fossa. The ileocolic and right branches of media colic vessels were identified and dissected after application of hemostatic clips. The colon was mobilized systematically via a medial-to-lateral approach. The minilaparotomy was performed by right paramedial incision. The incision was protected in every case with an isolation device. A side-to side antiperistalsis fully stapled anastomosis was performed with a 55 mm GIA stapler. The mesenteric defect was not closed.

Statistical analysis

Data analysis was performed using the SAS software, University Edition (SAS Institute Inc., Cary, NC, USA). Comparisons of continuous parameters were performed by Student's test or the Mann-Whitney test, according to data distribution. The χ^2 test or Fisher's exact test for small samples was used to compare categorical variables. All p-values are two-sided, and statistical significance is defined as $p \leq 0.05$.

Results

There were 92 patients who underwent laparoscopic right hemicolectomy in the period from January 2013 to December 2016. Seven patients were excluded – 6 due to conversion to an open procedure and 1 patient was excluded due to radiotherapy prior to surgery. Finally, 85 patients were included in the analysis. There were 53 males and 32 females with a mean age of 67.1 ±13.2 years. Mean BMI was 27.7

±4.8 kg/m^2. Twenty-eight patients had a history of at least one prior abdominal operation. Indications for surgery included neoplasm in 74 patients, and benign pathology in the rest. An intracorporeal anastomosis was performed in 51 patients, while an extracorporeal anastomosis was performed in 34. The groups were comparable in terms of demographic variables, which are shown in Table I. The surgical variables are shown in Table II. The duration of operations was significantly longer when intracorporeal anastomosis was performed, taking 154 ±58 min compared to 95 ±34 min in the extracorporeal group. No mortality was observed in the IA group. The postoperative mortality in the EA group was 8.8%, due to cardiorespiratory complications. Although statistical significance was not achieved, we consider the result clinically significant. We did not observe anastomotic leak in the IA group but the incidence of anastomotic leak in the EA group was 8.8%. Although statistical significance was not achieved, we consider the result clinically significant. Bleeding occurred in 1 patient in the IA group (2.0%), and in 2 cases in the EA group (5.9%). Other complications were clinically less common in the IA group (7.8%) compared to the EA group (23.5%). Reoperation was required in 9 cases in total. The rate of reoperation in the intracorporeal anastomosis group was 7.8%, whereas in the extracorporeal anastomosis group it was 14.7%. Of these cases, two underwent surgery due to internal bleeding, two due to anastomosis dehiscence and two due to wound dehiscence and evisceration. The rest of indications for reoperations included incarcerated hernia, intestinal fistula and postoperative ileus. Length of hospital stay in the IA

Table I. Baseline characteristics

Parameter	IE (n = 51)	EA (n = 34)	P-value
Age (range) [years]	66.2 (35–87)	68.6 (28–85)	0.229
Sex (M/F), n (%)	31 (60.8%)/20 (39.2%)	22 (64.7%)/12 (35.3%)	0.820
BMI (range) [kg/m^2]	27.9 (20.1–39.0)	27.6 (18.6–41.9)	0.668
ASA (I : II : III : IV)	5 (9.8%) : 33 (64.7%) : 13 (25.5%) : 0	3 (9.1%) : 22 (66.7%) : 7 (8.3%) : 1 (1.2%)	0.739
Previous abdominal surgery	17 (33.0%)	11 (32.3%)	1.000
Indication for surgery:			
Malignant/benign pathology	43 (84.3%)/8 (15.7%)	28 (82.4%)/6 (17.6%)	

Table II. Surgical outcomes

Parameter	IE (n = 51)	EA (n = 34)	P-value
Operative time (range) [min]	154 (55–335)	95 (30–210)	< 0.001
Number of lymph nodes removed (range)	14.3 (0–31)	9.7 (2–26)	0.117
Length of hospital stay, mean ± SD (range); median	5.3 ±3.7 (2–18); 4.0	11.2 ±19.8 (3–105); 5.0	0.022
Rate of complications:	5 (9.8%)	9 (26.4%)	0.071
Bleeding	1 (2%)	2 (5.9%)	0.561
Anastomotic leak	0	3 (8.8%)	0.060
Abdominal abscess	0	1 (3%)	0.400
Other	4 (7.8%)	8 (23.5%)	0.058
Rate of reoperation	4 (7.8%)	5 (14.7%)	0.474
Readmission	0 (0%)	1 (2.9%)	0.400
Mortality	0	3 (8.8%)	0.060

group was shorter in comparison to the EA group (5.3 ±3.7 vs. 11.2 ±19.8 days, p = 0.022). The majority of complications occurred during index hospitalization and 30-day readmission rates were comparable between IA and EA groups (0.0% vs. 2.9%). Pathological outcomes are presented in Table III.

Discussion

Mini-invasive colon surgery is increasingly regarded as the gold standard for benign and malignant lesions. Short-term advantages of the laparoscopic approach for colon resection are well recognized [4]. The safety and oncological radicality of mini-invasive colectomy have been proven by many randomized, controlled trials (COLOR, CLASSIC, BARCELONA, COST) [5–8]. Each type of colon resection has his own level of difficulty. Jamali *et al.* showed that laparoscopic right hemicolectomy with extracorporeal anastomosis is more technically demanding than sigmoidectomy and its difficulty is on the rise when anastomosis is managed totally intracorporeally [9]. Thus, this is a reason why the majority of surgeons still choose to perform EA [10, 11]. Although rapid implementation of miniinvasive technique in

Table III. Pathological findings. TNM staging was applied for patients with diagnosis of adenocarcinoma

Characteristics	IE (n = 51)	EA (n = 34)	P-value
Pathological diagnosis:			0.382
Adenocarcinoma	43 (84.3%)	28 (82.4%)	
Adenoma	5 (9.8%)	4 (11.8%)	
Appendicitis	1 (1.96%)	0	
Colitis chronica	0	1 (2.9%)	
Crohn's disease	1 (1.96%)	0	
GIST	1 (1.96%)	0	
Neuroendocrine tumor	0	1 (2.9%)	
T staging:			0.645
T1	2 (4.6%)	2 (7.1%)	
T2	9 (20.9%)	5 (17.9%)	
T3	29 (67.4%)	18 (64.3%)	
T4	3 (7.0%)	3 (10.7%)	
N staging:			0.352
N0	23 (53.5%)	18 (64.3%)	
N1	10 (23.3%)	5 (17.8%)	
N2	10 (23.3%)	5 (17.8%)	
M staging:			1.000
M0	34 (79.1%)	23 (82.1%)	
M1	9 (20.9%)	5 (17.9%)	
Grading:			0.872
G1	2 (4.6%)	2 (7.1%)	
G2	38 (88.4%)	24 (85.7%)	
G3	3 (7.0%)	2 (7.14%)	
G4	0	0	

colorectal surgery is possible, the main obstacle for intracorporeal anastomosis is a need for advanced suturing and binding skills [12].

Many studies try to show which type of anastomosis offers more benefits. Still there are controversies. The meta-analysis by Feroci *et al.* showed no statistically significant differences in operating time, post-surgical complications, reoperations, number of isolated lymph nodes or mortality [13]. However, the meta-analysis performed by Milone *et al.* revealed that mini-invasive colon surgery with intracorporeal anastomosis was associated with a lower rate of postoperative complications. The main difference was consistently found for less severe class I and II [14]. Similar results were observed in our study. The length of hospital stay was shorter in the IA group in comparison to the EA group. It was caused by a lower rate of complications in the IA group. The leak rate in this group corresponds with the leak rate reported by other Polish group [15]. However, in the EA group we noted a high incidence of complication class III, especially anastomosis leak. In our opinion, this difference may have resulted from the different technical approach to anastomosis. In the EA group, it was fully stapled and antiperistalsis. It resulted in crossing the staple line and the tendency for twisting.

Incisional hernia is a common complication of both open and keyhole surgery. The incisional hernia is a common complication of both open and keyhole surgery. The initial enthusiasm for a lower rate of herniation after the mini-invasive approach was partly tempered. The main point of concern is the extraction site. The midline incision, which is most preferable for EA, is associated with the highest risk of herniation. Two prospective randomized trials showed almost the same rate of hernia for the midline incision despite of type of approach. The reported range in the study done by Winslow *et al*. was 24.3% versus 19.6% for laparoscopic versus open surgery respectively [16]. Although the trial done by Braga *et al*. showed lower risk of hernation in mini-invasive group 4.7% versus 8.9% in open group, the difference was not significant [17].

One of the main benefits of the IA approach is free choice of the site of mini-laparotomy. The study performed by DeSouza *et al.* analyzed the ideal extraction site for mini-invasive colorectal resection and they found that a Pfannenstiel incision was associated with the lowest rate of incisional hernia; therefore, it was their recommendations to use it for laparoscopic colorectal surgery wherever applicable [18]. Nevertheless, in their study, the Pfannenstiel incision was used mainly for anterior resection, while right colectomies were mainly performed using a mini midline laparotomy incision. Data suggest that the Pfannenstiel incision is superior to others in terms of hernia rate [19, 20]. The size of specimen could also reduce the benefits of the laparoscopic approach, especially for an EA, but using the Pfannenstiel incision gives a clear advantage for pain control and hernia rate even in the case of greater length of the wound [21, 22].

One of the most important factors for increased level of difficulty of surgery is obesity [23]. The length of incision for extracorporeal anastomosis is often associated with the level of obesity. The reason for this is the thickness of abdomen wall and lower mobility of mesentery. The benefits of IA in this group of patients are more visible [24].

Additional benefits of IA are: mobilization of the bowel is performed under direct vision, with lack of traction on the mesentery. Therefore, it reduces the risk of mesenteric tears, bleeding and torsion of the mesentery. These advantages could result in enhanced recovery, decreased complication rate, less adhesion formation and improved long-term results [25, 26].

Some limitations of the study should be addressed. First, this is a retrospective analysis. Second, due to the small sample size there is a risk of II type errors. Third, this study was not randomized. For these reasons we considered the *p*-value below 0.1 as clinically significant.

Conclusions

Our results are encouraging to consider the intracorporeal approach the better way to perform the anastomosis after laparoscopic right hemicolectomy. This study clearly provides the rationale for randomized clinical trials, which would be useful to give a definitive answer.

Conflict of interest

The authors declare no conflict of interest.

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