

# A comparison of extracorporeal and intracorporeal anastomosis in patients undergoing laparoscopic right hemicolectomy for right colon tumors

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## ABSTRACT

**Introduction:** Colorectal cancer is a global health concern, and laparoscopic right hemicolectomy is widely performed for right-sided colon tumors. The choice between intracorporeal and extracorporeal anastomosis in laparoscopic right hemicolectomy remains controversial. This study compares early outcomes of these techniques.

**Materials and Methods:** A retrospective analysis of 61 patients who underwent laparoscopic right hemicolectomy between 2019 and 2024 was conducted. The patients were divided into two groups: intracorporeal anastomosis (n=20) and extracorporeal anastomosis (n=41). The patients were evaluated in terms of their demographic characteristics, perioperative findings, and histopathological results. Statistical significance was defined as  $p < 0.05$ .

**Results:** The operative time was significantly shorter in the extracorporeal anastomosis group ( $181.95 \pm 26.88$  vs.  $200.0 \pm 24.17$  minutes,  $p = 0.015$ ). Hospital stay duration was similar between groups ( $6.10 \pm 1.14$  vs.  $6.50 \pm 0.89$  days,  $p = 0.165$ ). The median number of dissected lymph nodes was comparable (24 vs. 25.5,  $p = 0.742$ ). Surgical site infection rates (12.2% vs. 5.0%,  $p = 0.376$ ), ileus (26.8% vs. 20.0%,  $p = 0.561$ ), and anastomotic leakage (7.3% vs. 5.0%,  $p = 0.731$ ) showed no significant differences. No mortality was observed.

**Conclusion:** Both intracorporeal and extracorporeal anastomosis are safe and effective techniques for laparoscopic right hemicolectomy, with no clear advantage regarding complications or oncological outcomes. The shorter operative time in the extracorporeal anastomosis group may favor its use in certain cases. Further randomized trials are needed to clarify long-term outcomes and support surgical decision-making.

**Keywords:** Colorectal cancer, extracorporeal anastomosis, intracorporeal anastomosis, laparoscopic right hemicolectomy

## Introduction

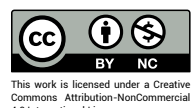
Colorectal cancer is a significant global health issue, ranking as the second most lethal and the third most common cancer worldwide.<sup>[1]</sup> The incidence of colorectal cancer among adults aged 50 years and older has been

decreasing due to increased awareness among the public and healthcare professionals, as well as the widespread adoption of early screening tests.<sup>[2]</sup> Surgical treatment remains the cornerstone of therapy for colorectal cancer.<sup>[3]</sup>



Received: 28.12.2024 Revision: 02.01.2025 Accepted: 10.01.2025

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Laparoscopic right hemicolectomy is now a commonly performed procedure in the treatment of right-sided colon cancer.<sup>[4]</sup> Since its introduction in 1991, laparoscopic right hemicolectomy has gained popularity, offering advantages such as faster recovery and fewer early postoperative complications compared to open right hemicolectomy.<sup>[5-7]</sup>

One of the controversial topics in the application of laparoscopic right hemicolectomy is determining whether the intracorporeal anastomosis technique is superior to the extracorporeal anastomosis technique. The impact of the chosen technique on both early and long-term patient outcomes remains a subject of ongoing debate and investigation.

In our study, we aimed to contribute to this discussion by analyzing the early outcomes of patients in our clinic who underwent laparoscopic right hemicolectomy for right-sided colon cancer with either intracorporeal anastomosis or extracorporeal anastomosis techniques.

## Materials and Methods

Patients who underwent laparoscopic right hemicolectomy for right colon tumors in the general surgery clinic of our hospital between 2019 and 2024 were included in the study. A total of 41 patients who underwent extracorporeal anastomosis and 20 patients who underwent intracorporeal anastomosis were included in the study. Patient data were retrospectively reviewed from medical records.

Histopathological data, including grade, lymphovascular invasion (LVI), perineural invasion (PNI), the presence of a mucinous component (MC), disease stage, and tumor size, were obtained through pathological examination of the surgical specimens. Patients who underwent open surgery, were unable to complete laparoscopic surgery for any reason, had malignancies other than adenocarcinoma, were operated on for benign causes, or had incomplete data were excluded from the study.

The patient was positioned supine, and the surgery was initiated. A 10-mm camera trocar was placed through the umbilicus, and the abdominal cavity was insufflated with carbon dioxide (CO<sub>2</sub>). Subsequently, two 5-mm working trocars were placed in the right and left lower quadrants, and a 10-12 mm working trocar was positioned in the epigastric region to proceed with the operation.

As a surgical technique, a standard mesocolic excision was performed using a medial-to-lateral approach. Dur-

ing this procedure, the ileocolic artery and vein, as well as the right colic artery and vein (if present), were ligated and divided.

For patients undergoing intracorporeal anastomosis, a side-to-side ileotransversostomy was performed intracorporeally using a laparoscopic Endo-GIA stapler. Subsequently, the specimen was removed through an incision in the epigastric region, and the operation was concluded.

For patients undergoing extracorporeal anastomosis, after the resection was completed, the specimen was extracted through an incision in the epigastric region, and a side-to-side ileotransversostomy was routinely performed manually through this incision. All surgeries were carried out by the same surgical team following consistent standards.

To compare surgical outcomes, patients who underwent extracorporeal anastomosis and intracorporeal anastomosis were retrospectively evaluated in terms of operation time, length of hospital stay, number of dissected lymph nodes, postoperative surgical site infection (SSI), ileus, anastomotic leakage, and mortality.

## Statistical Analysis

All statistical analyses were performed using the SPSS (Statistical Package for Social Sciences) for Windows 25.0 software. Normality was tested using the Shapiro-Wilk test and graphical methods. For non-normally distributed data, we used mean and standard deviation for the expression of study data. For normally distributed variables, we expressed the data using the median and minimum-maximum values. Additionally, we added the numeric (n) values and percentages (%) for the data. The Chi-square test was employed for the comparison of two categorical variables. However, when we compared one categorical variable with a numeric value, we used the Independent Sample T-test for normally distributed data and the Mann-Whitney U test for the non-normally distributed data. All statistical calculations were two-sided, and  $p < 0.05$  indicated statistical significance at a 95% confidence interval.

## Results

The study included 61 patients who met the inclusion criteria. Age, BMI, operative time, and length of hospital stay were not normally distributed, whereas the number of dissected lymph nodes and tumor size followed a normal distribution.

The mean age of the patients was  $63.52 \pm 14.36$  years, the mean BMI was  $25.93 \pm 5.11$  kg/m<sup>2</sup>, the mean operative time was  $187.87 \pm 27.19$  minutes, and the mean hospital stay was  $6.23 \pm 1.07$  days. The median number of dissected lymph nodes was 25 (range: 10–48). Of the patients, 45.9% (n=28) were male. Regarding ASA (American Society of Anesthesiologists) classification, 59.0% (n=36) were ASA 2, 36.1% (n=22) were ASA 3, and 4.9% (n=3) were ASA 4. Comorbidities were present in 29.5% (n=18) of the patients, including hypertension (15 patients), diabetes mellitus (8 patients), chronic obstructive pulmonary disease (3 patients), and coronary artery disease (6 patients).

The pathological stage was Stage 1–2 in 60.7% (n=37) of the patients and Stage 3 in 39.3% (n=24). The tumors of the patients were 9.8% (n=6) T2, 82.0% (n=50) T3, and 8.2% (n=5) T4. Tumor differentiation was poor in 13.3% (n=8), moderate in 70.0% (n=42), and good in 16.7% (n=10) of the patients. Lymphovascular invasion (LVI) was detected in 34.4% (n=21), perineural invasion (PNI) in 21.3% (n=13), and mucinous components in 27.9% (n=17) of the cases. Mucinous adenocarcinoma was identified in 8.2% (n=5) of the patients.

Extracorporeal anastomosis was performed in 67.2% (n=41) of the patients, while intracorporeal anastomosis was performed in 32.8% (n=20). When intracorporeal anastomosis and extracorporeal anastomosis groups were compared regarding age, BMI, tumor size, ASA score, gender, presence of comorbidities, pathological stage, grade, LVI, PNI, and mucinous components, no statistically significant differences were found, and the groups were determined to be homogeneously distributed (Table 1).

In the comparison of intraoperative findings between the intracorporeal anastomosis and extracorporeal anastomosis groups, the operative time was significantly shorter in the extracorporeal anastomosis group compared to the intracorporeal anastomosis group ( $p=0.015$ ). No statistical differences were observed between the two groups regarding hospital stay ( $6.10 \pm 1.14$  vs.  $6.50 \pm 0.89$  days,  $p=0.165$ ), the number of dissected lymph nodes (24 vs. 25.5,  $p=0.742$ ), SSI rates (12.2% vs. 5.0%,  $p=0.376$ ), ileus (26.8% vs. 20.0%,  $p=0.561$ ), and anastomotic leakage (7.3% vs. 5.0%,  $p=0.731$ ). Mortality was not observed in either group (Table 2).

## Discussion

In our study, no significant differences were observed between the intracorporeal anastomosis and extracorporeal anastomosis groups, which were demographically homogeneous, regarding early postoperative complications, the number of dissected lymph nodes, and hospital stay. However, the operative time was found to be shorter in the extracorporeal anastomosis group.

The literature includes numerous studies comparing intracorporeal anastomosis and extracorporeal anastomosis. While studies comparing postoperative complications yield varying results, the majority suggest that intracorporeal anastomosis is superior in terms of early postoperative complications.

The incidence of postoperative anastomotic leakage was found to be similar in both groups across reviewed studies, and no superiority of intracorporeal anastomosis or extracorporeal anastomosis was demonstrated.<sup>[8-13]</sup> Consistent with these findings, our study also found no significant difference between the groups regarding anastomotic leakage.

Regarding the frequency of surgical site infections (SSI) in the early postoperative period, no significant differences were observed between the groups.<sup>[8-11]</sup> However, studies by Milone M. et al.<sup>[12]</sup> and Shapiro R. et al.<sup>[13]</sup> reported a lower incidence of SSI in the intracorporeal anastomosis group. In our study, no significant differences were found between the groups.

Some studies indicate that postoperative bowel function recovery is delayed in the extracorporeal anastomosis group, leading to a higher incidence of postoperative ileus.<sup>[9,11,12]</sup> Other studies found no significant difference between the groups.<sup>[8,10,13]</sup> Considering the greater manual traction on the intestines and more extensive abdominal manipulation in the extracorporeal anastomosis group, the higher frequency of postoperative ileus in this group is understandable. However, no significant differences were observed in our study.

Most studies in the literature report shorter operative times in favor of the extracorporeal anastomosis group.<sup>[9,11,13,14]</sup> Some studies, however, found no differences between the groups.<sup>[9,12]</sup> Interestingly, the CLIMHET study group reported shorter operative times for intracorporeal anastomosis, although no explanation was provided.

Table 1. Clinical and demographic features

	ECA n=41 (67.2%)	ICA n=20 (32.8%)	p
Age (years), Mean±SD	61.66±15.49	67.35±11.08	0.213
BMI (kg), Mean±SD	26.19±5.21	25.39±4.99	0.639
Tumor Size (cm), median (min-max)	5.0 (2.0-7.0)	5.0 (2.0-7.5)	0.657
Gender, n (%)			
Male	20 (48.8)	8 (40.0)	0.518
Female	21 (51.2)	12 (60.0)	
ASA Score, n (%)			
2	20 (48.8)	8 (40.0)	0.408
3	20 (48.8)	10 (50.0)	
4	1 (2.4)	2 (10.0)	
Comorbidity, n (%)			
No	28 (68.3)	11 (55.0)	0.310
Yes	13 (31.7)	9 (45.0)	
Stage, n (%)			
Stage 1-2	25 (61.0)	12 (60.0)	0.942
Stage 3	16 (39.0)	8 (40.0)	
T stage, n (%)			
T2	3 (7.3)	3 (15.0)	0.577
T3	35 (85.4)	15 (75.0)	
T4	3 (7.3)	2 (10.0)	
Grade, n (%)			
Well	6 (15.0) <sup>a</sup>	4 (20.0)	0.121
Moderate	31 (77.5)	11 (55.0)	
Poor	3 (7.5)	5 (25.0)	
LVI, n (%)			
No	26 (63.4)	14 (70.0)	0.611
Yes	15 (36.6)	6 (30.0)	
PNI, n (%)			
No	32 (78.0)	16 (80.0)	0.861
Yes	9 (22.0)	4 (20.0)	
MC, n (%)			
No	27 (65.9)	12 (60.0)	0.888
Yes	11 (26.8)	6 (30.0)	
Mucinous cancer	3 (7.3)	2 (10.0)	

<sup>a</sup>One missing case; ASA: American Society of Anesthesiologists Score; LVI: Lymphovascular invasion; PNI: perineural invasion; MC: mucinous components; BMI: Body mass index.

Consistent with the majority of the literature, our study found that operative time was shorter in the extracorporeal anastomosis group.

In oncological surgery, regardless of the technique chosen, adherence to oncological principles is paramount. Across

all studies reviewed, the number of dissected lymph nodes was found to be similar between the intracorporeal anastomosis and extracorporeal anastomosis groups.<sup>[9,11,12]</sup>

While some studies suggest a shorter hospital stay for the intracorporeal anastomosis group,<sup>[9,10,14]</sup> others report no

**Table 2. Perioperative and postoperative outcomes between extracorporeal anastomosis and intracorporeal anastomosis groups**

	ECA n=41 (67.2%)	ICA n=20 (32.8%)	p
Operation Time (min), Mean±SD	181.95±26.88	200.0±24.17	0.015 <sup>a</sup>
Length Of Hospital Stay (day), Mean±SD	6.10±1.14	6.50±0.89	0.165
Dissected Lymph Node, median (min-max)	24 (10-48)	25.5 (11-45)	0.742
SSI, n (%)	5 (12.2)	1 (5.0)	0.376
Ileus, n (%)	11 (26.8)	4 (20.0)	0.561
Anastomosis Leak	3 (7.3)	1 (5.0)	0.731
Mortality	-	-	-

<sup>a</sup>Statistically significant at the confidence level of 0.95; SSI: surgical site infection.

significant differences.<sup>[8,11,12]</sup> In our study, no significant difference in hospital stay was observed between the groups. Generally, the lower incidence of postoperative complications in the intracorporeal anastomosis group, as reported in the literature, may explain the shorter hospital stays for this group.

A 2023 meta-analysis that reviewed seven randomized controlled trials involving 750 patients reported a lower incidence of paralytic ileus in the intracorporeal anastomosis group compared to the extracorporeal anastomosis group, while operative times were longer for the intracorporeal anastomosis group. However, perioperative complications such as bleeding, wound infections, anastomotic leakage, hospital stay, and the number of dissected lymph nodes were found to be similar between the two groups.<sup>[15]</sup>

Many studies in the literature analyze the short- and long-term outcomes of intracorporeal anastomosis and extracorporeal anastomosis techniques in laparoscopic right hemicolectomy. Overall, no significant differences in early postoperative mortality or survival have been observed between intracorporeal anastomosis and extracorporeal anastomosis. Thus, both techniques have been proven to be reliable options.

Our study has certain limitations. First, it is a retrospective study. Additionally, the sample size, particularly in the intracorporeal anastomosis group, is limited because intracorporeal anastomosis is technically more challenging, and fewer surgeons are proficient in this technique. Consequently, achieving comparable group sizes was not possible. However, the demographic and pathological characteristics of the groups were homogeneous, allow-

ing for valid comparisons. Furthermore, since the choice of technique was left to the surgeon's discretion, randomization was not feasible, which likely resulted in surgeons opting for the technique they were most skilled at. Lastly, our study focused solely on short-term outcomes.

## Conclusion

The findings of our study are generally consistent with the literature. Both techniques appear to be viable options, particularly when considering oncological outcomes and complications such as anastomotic leakage that could increase mortality. Based on our findings, we conclude that both techniques are applicable depending on the surgeon's expertise, with no clear superiority of one technique over the other. However, considering the conflicting data in the literature, randomized controlled trials with larger patient populations are warranted.

## Disclosures

**Ethics Committee Approval:** The study was approved by Sehit Prof. Dr. İlhan Varank Training and Research Hospital. Local Ethics Committee. (No: 2024 /205, Date: 26/06/2024).

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** None declared.

**Funding:** There are no financial conflicts of interest to disclose.

**Authorship Contributions:** Concept – C.B.O., F.M.; Design – C.B.O., F.M.; Supervision – C.B.O., F.M.; Funding – C.B.O.; Materials – F.M.; Data Collection – C.B.O.; Analysis and/ or interpretation – C.B.O., F.M.; Literature Search – F.M.; Writing – C.B.O., F.M.; Critical Review – F.M.

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