

# Laparoscopic Extended Hemicolectomy vs Laparoscopic Transverse Colectomy for Management of Mid-transverse Colon Cancer—Which is the Optimal Surgical Approach?

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## ABSTRACT

**Background:** Laparoscopic-assisted surgical approach performing either extended right or left hemicolectomy or performing only conservative approach by transverse colectomy could be considered as various management approaches of cancer of the transverse colon but a consensus of which technique is the best is still lacking. So the choice of surgical approach depends on the preference and experience of the operating surgeon.

**Aim:** The aim of this study was to compare performing laparoscopic extended right or left hemicolectomy and performing transverse colectomy for management of transverse colon cancer located in the middle part of the transverse colon regarding surgical and oncological findings and patients' outcomes to prove which surgical approach is the best.

**Patients and methods:** We analyzed collected data of 120 patients with mid-transverse colon cancer. We divided them into two groups: the first group included 80 patients who were managed by right or left hemicolectomy and the second group included 40 patients who were managed by transverse colectomy. We evaluated operative, postoperative, and follow-up data of all included patients.

**Results:** The length of specimens was longer in the hemicolectomy group than that in the transverse colectomy group ( $p = 0.007$ ). The numbers of dissected lymph nodes were significantly higher in the hemicolectomy group than in the transverse colectomy group ( $p < 0.001$ ). The duration of operative time was longer in the hemicolectomy group than in the transverse colectomy group ( $p = 0.014$ ). The group of patients in the hemicolectomy group experienced a higher rate of recovery findings than the transverse colectomy group. The group of patients in the hemicolectomy group experienced lower rates of intraoperative and perioperative complications than the transverse colectomy group ( $p = 0.002$ ). Five years of overall survival (OS), progression-free survival (PFS), and disease-free survival (DFS) rates were slightly longer in the hemicolectomy groups than those in the transverse colectomy group, but results were not statistically significant.

**Conclusion:** We concluded that hemicolectomy is a better surgical approach of management of cancer located in the mid-transverse colon regarding operative and short-term outcomes than transverse colectomy, but regarding oncological outcomes, both techniques are considered safe and feasible.

**Keywords:** Hemicolectomy, Laparoscopic, Mid-transverse colon cancer, Transverse colectomy.

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## INTRODUCTION

Carcinoma which is located in the transverse colon forms about 10% of all colorectal cancers.<sup>1</sup> The survival rates and patients' outcomes were found to be worse than cancers located elsewhere in the colon and rectum.<sup>2</sup> This dismal outcome might be due to, late discovery and diagnosis, dual lymphatic metastases along both branches of mesenteric vessels, and proximity to vital abdominal organs.<sup>3</sup>

Laparoscopic-assisted surgical management of cancer of the transverse colon is recently gaining acceptance to be an optimal management procedure. But the optimal approach for the management of cancer located in the mid-transverse colon is still controversial.<sup>4</sup>

Previous reports stated that performing either extended right or left hemicolectomy or only conservative approach by transverse colectomy could be considered various management approaches, but a consensus of which technique is the best is still lacking. So the choice of surgical approach depends on the preference and experience of the operating surgeon.<sup>1</sup>

The aim of this study was to compare performing laparoscopic extended right or hemicolectomy and performing transverse colectomy for the management of transverse colon cancer located in the middle part of the transverse colon regarding surgical and oncological findings and patients' outcomes to prove which surgical approach is the best.

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**Conflict of interest:** None

## PATIENTS AND METHODS

### Patients

This prospective study was approved by the local ethics committee of Faculty of Medicine, Zagazig University Institutional Review Board.

We analyzed the collected data of mid-transverse colon cancer patients who were surgically managed by either laparoscopic-

assisted, transverse colectomy, extended right hemicolectomy, or extended left hemicolectomy. All patients were admitted and operated in the General Surgery Department, Zagazig University Hospitals, in the period between January 2015 and April 2020.

Mid-transverse colon cancer is the term used when the cancer is determined during surgical exploration to be found in the middle part of the transverse colon, about 10 from each of the splenic or hepatic flexures.

### Inclusion Criteria

Patients aged from 20–70 years with clinical, radiological, and histopathological diagnoses of adenocarcinoma of the transverse colon stages from I to III are included for the research.

### Exclusion Criteria

We excluded patients with stage IV colon cancer who primarily presented with distant metastases; patients with multiple foci of colon cancer; patients with concomitant cancer in other organs; patients with emergent surgical intervention for the management of cancer-related intestinal obstruction, severe bleeding, or perforation; and patients with inflammatory bowel diseases or familial adenomatous polyposis.

After the application of inclusion and exclusion criteria of the current study, we included 120 cases with mid-transverse colon cancer. We divided them into two groups: the first group included 80 patients who were managed by right or left hemicolectomy and the second group included 40 patients who were managed by transverse colectomy.

Patients selected to perform transverse colectomy, right or left hemicolectomy, were made according to the choice and evaluation of the surgeon.

### Surgical Techniques<sup>5</sup>

We performed surgery by using five ports, and we performed lymphadenectomy in a caudal-to-cranial or cranial-to-caudal manner along the superior mesenteric vein. We pulled out the intestine from a minute incision and then transected it by linear staplers in all included patients.

For cases that underwent hemicolectomy whether right or left, we ligated that middle colic vessels at their origin for right hemicolectomy and ligated the left colic and the left branch of the middle colic pedicles at their origins for left hemicolectomy with D2 or D3 lymphadenectomy.

For cases that underwent transverse colectomy, we have resected the bowel segment located between both hepatic flexure and splenic flexure, in addition to its lymphatic and vascular supply that is located along the pedicle of middle colic vessel with its ligation at its origin with D2 or D3 lymphadenectomy. Then, restoration of the bowel was done by side-to-side or end-to-end anastomoses.

We recorded all demographic patients' data such as age, sex, and BMI; pathological findings such as tumor histopathological subtype, grade, stage, number of dissected and positive lymph nodes, specimen length, and distances from both proximal and distal resected margins; operative findings such as operative time, complications, bleeding, and conversion rate; and postoperative data such as postoperative pain, bleeding, surgical wound infection, intestinal obstruction, and anastomotic leakage.

Postoperative complications were defined as any adverse findings that happened during 30 days from surgery. Bleeding was considered as a complication if the bleeding patient needs a blood

transfusion. Pain is considered a severe complication if the patient needs high dose of analgesia. We defined anastomotic leakage as any clinical or radiological evidence of dehiscence which needs or not surgical intervention.

Patients were allowed to exit from the hospitals in the case of absence of symptoms, regular stool passage, and meals' tolerance.

### Oncological and Follow-up Findings

We followed our patients at the outpatient clinic during the first 2 years after operation every 3 months; then, we followed them every 6 months for the remaining 3 years.

During the follow-up period, we regularly measured carcino-embryonic antigen (CEA) and cancer antigen (CA19-9), we performed computed tomography of the abdomen and chest every 6 months, and we performed total colonoscopy every 2 years. We assessed and analyzed overall survival (OS), progression-free survival (PFS), and disease-free survival (DFS) rates during the follow-up.

We performed a separate analysis for comparison between both hemicolectomy and transverse colectomy groups.

### Data Analysis

Clinical data, demographic data, pathological findings, operative, postoperative, and follow-up data were collected, tabulated, and statistically analyzed. We compared continuous data using Student's *t*-test or Mann-Whitney *U*-test whenever needed. We analyzed categorical data using either Chi-square or Fisher's exact tests. For estimation of survival rates such as OS, PFS, and DFS rates, we used Kaplan-Meier curves and the log-rank test for comparison between survival curves. Statistical analyses were two sided, and we considered *p* value of less than 0.05 as a significant value. We used the statistical program Advanced Statistics (IBM SPSS Statistics v20.0, IBM Corporation, Armonk, New York).

## RESULTS

### Demographic and Clinical Results

Table 1 denoted that there were no statistically significant differences in both groups regarding all demographic patients' data such as age, sex, and BMI and pathological findings such as tumor histopathological subtype, grade, and stage.

There was a statistically significant difference in the length of specimens, lengths of proximal and distal margins between both groups; they were longer in the hemicolectomy group than in the transverse colectomy group ( $p = 0.007$ ). The numbers of dissected lymph nodes were significantly higher in the hemicolectomy group than in the transverse colectomy group ( $p < 0.001$ ). The numbers of positive lymph nodes were higher in the hemicolectomy group than in the transverse colectomy group, but this was not statistically significant (Tables 2 to 4).

### Operative and Perioperative Results

The duration of operative time was longer in the hemicolectomy group than in the transverse colectomy group ( $p < 0.001$ ). There were no statistically significant differences in both groups regarding conversion rates.

The group of patients in the hemicolectomy group experienced a higher rate of recovery findings such as shorter time to first flatus, time to first mobilization, and shorter time to first meal, and shorter duration of hospital stay than those in the transverse colectomy group (0.014).

**Table 1:** Demographic, clinicopathological, operative, postoperative, and outcome findings of all included patients

Patients' clinical characteristics and outcomes		All population	
		N	%
Age (years)		55 (29–80)	
Sex	Female	42	35.0%
	Male	78	65.0%
Size	≤5 cm	75	62.5%
	>5 cm	45	37.5%
Histopathological subtype	Conventional adenocarcinoma	105	85%
	Mucoid carcinoma	15	15%
DUKE stage	A	36	30.0%
	B	33	27.5%
	C	51	42.5%
Stage	I	36	30.0%
	II	43	35.8%
	III	41	34.2%
LN metastases	No	79	65.8%
	Yes	41	34.2%
Number of lymph nodes harvested		20 (9–28)	
Grade	I	33	27.5%
	II	78	65.0%
	III	9	7.5%
Length of the specimen		50 (20–100)	
Margin status	R0	114	95.0%
	R1	6	5.0%
Duration of hospital stay	5	16	13.3%
	6	28	23.3%
	7	31	25.8%
	8	26	21.7%
	9	19	15.8%
30-day morbidity	No	114	95.0%
	Yes	6	5.0%
30-day mortality	No	117	97.5%
	Yes	3	2.5%
Operative time minute		110 (90–150)	
Operative complications	0	114	95.0%
	1	6	5.0%
Postoperative complications	0	107	89.2%
	1	13	10.8%
Relapse	No	96	80.0%
	Yes	24	20.0%
Death	No	107	89.2%
	Yes	13	10.8%

The group of patients in the hemicolectomy group experienced lower rates of intraoperative and perioperative complications than the transverse colectomy group ( $p = 0.002$ ,  $p = 0.017$ ).

There were no statistically significant differences in both groups regarding 30-day postoperative outcomes.

### Survival and Patients' Outcome Results

There were no statistically significant differences between both groups, regarding disease, local or systemic recurrence, progression, and the use of or response to chemotherapy.

Five years of OS, PFS, and DFS rates were slightly longer in the hemicolectomy groups than in the transverse colectomy group, but the results were not statistically significant.

All these data analyses confirm the advantages of hemicolectomy over transverse colectomy.

### DISCUSSION

Although transverse colon cancer forms about 10th of all colon cancer cases, a consensus about the best management strategy for such cancer is still lacking.<sup>6</sup> Survival rates of cancer located in the transverse colon are lower than survival rates of cancer located in other parts of the colon.<sup>7</sup> This dismal outcome is mostly due to sending lymph node metastases to lymph nodes located around both superior and inferior mesenteric vessels in addition to proximity to vital abdominal organs that made surgical management is difficult with a higher incidence of postoperative complications.<sup>3</sup>

Previous studies compared both conservative approaches by surgical removal of only the transverse colon, while others prefer the extended right or left hemicolectomy to achieve more treatment that is radical and removal of more lymph nodes.<sup>8</sup>

Moreover, laparoscopic-assisted surgery is now considered the best management approach for colon and rectal cancers.<sup>9,10</sup>

Most previous studies compared laparoscopic and open surgical management of colon cancer,<sup>11,12</sup> but only a few studies compared laparoscopic-assisted conservative transverse colectomy and extended hemicolectomy for management of transverse colon cancer.

In the present study, we included cases with mid-transverse colon cancer that was managed by either right or left hemicolectomy compared them by cases managed by transverse colectomy.

We showed that both laparoscopic-assisted right or hemicolectomy or laparoscopic-assisted transverse colectomy could be proper management options for cancer located in the mid-transverse colon, as we showed that operative, clinical, and oncological outcomes were nearly the same for both groups, but the incidence of postoperative complications was higher in patients underwent transverse in comparison with patients underwent hemicolectomy which is similar to the results of Matsuda et al.<sup>4</sup> and Milone et al.<sup>1</sup>

We showed that as the number of dissected lymph nodes is more in the hemicolectomy group than that in the transverse colectomy group, hemicolectomy leads to more radical management than conservative transverse colectomy.

Leijssen et al.<sup>13</sup> and van Rongen et al.<sup>14</sup> showed that despite fewer harvested lymph nodes in the transverse colectomy group, they showed that no differences between transverse colectomy and hemicolectomy regarding operative and postoperative complications concluded that performing transverse colectomy is an oncologically safe and suitable management approach for cancer of the mid-transverse colon stages from I to III, but the limitation of both studies is the small number of included patients made their results need further modifications.

Matsuda et al.<sup>4,5</sup> showed that both transverse colectomy and hemicolectomy have similar advantages and oncological outcomes, but their study was retrospective and included a small number of patients.

We showed that the duration of operative time was longer in the hemicolectomy group than that in the transverse colectomy group, but we showed that the group of patients

**Table 2:** Correlations between both included groups of patients underwent both surgical techniques regarding demographic and clinicopathological findings

Patients' clinical characteristics		Management surgical technique						p
		Extended right and left hemicolectomy		Transverse colectomy		Total		
		N	%	N	%	N	%	
Age (years)*		55 (29–80)		55 (29–80)		55 (29–80)		1
Sex	Female	28		14	35.0%	42	35.0%	1
	Male	52		26	65.0%	78	65.0%	
Size	≤5 cm	50		25	62.5%	75	62.5%	1
	>5 cm	30	37.5%	15	37.5%	45	37.5%	
Histopathological subtype	Conventional adenocarcinoma	70	85%	35	85%	105	85%	0.958
	Mucoid carcinoma	10	15%	5	15%	15	15%	
DUKE stage	A	24	30.0%	12	30.0%	36	30.0%	1
	B	22	27.5%	11	27.5%	33	27.5%	
	C	35	42.5%	17	42.5%	51	42.5%	
Stage	I	24	30.0%	12	30.0%	36	30.0%	0.771
	II	28	35.0%	12	30.0%	43	35.8%	
	III	28	35.0%	16	40.0%	41	34.2%	
LN metastasis	No	52	65.0%	24	60.0%	79	65.8%	0.495
	Yes	28	35.0%	16	40.0%	41	34.2%	
Number of lymph nodes harvested*		24 (10–28)		20 (10–27)		20 (9–28)		<0.001 <sup>f</sup>
Grade	I	22	27.5%	11	27.5%	33	27.5%	1
	II	52	65.0%	26	65.0%	78	65.0%	
	III	6	7.5%	3	7.5%	9	7.5%	
Length of the specimen		70–100	30–60					0.007
Margin status	R0	38	95.0%	38	95.0%	114	95.0%	1
	R1	2	5.0%	2	5.0%	6	5.0%	

All variables were compared using Chi-square test except (\*) Mann–Whitney U-test

in the hemicolectomy group experienced a higher rate of recovery findings and experienced lower rates of intraoperative and perioperative complications than those in the transverse colectomy group. Our results were slightly different from the results of Chong et al.,<sup>3</sup> who reported no significant differences in operative time or incidence of postoperative complications between both transverse and hemicolectomy groups that suggest safety and feasibility of the conservative approach; moreover, they showed that the extent of lymphadenectomy in the transverse colectomy was sufficient for adequate radicalism and accurate cancer staging.

We showed that there were no statistically significant differences between both groups regarding 5-year OS and DFS rates in each group which is similar to the results of Guan et al.<sup>15</sup> Matsuda et al.<sup>9,10</sup> reported that in their group of patients the 5-year OS was worse than the 5-year DFS and explained their results by that most patients who died were from diseases other than cancer.

We showed that although dissected lymph nodes were higher in the lymphadenectomy group, the incidence of positivity was similar in both groups; similarly, Milone et al.<sup>16</sup> and Guan et al.<sup>15</sup> concluded safety and feasibility of transverse colectomy as a less aggressive and a more advisable approach of surgical management of mid-transverse colon cancer.

Milone et al.<sup>1</sup> showed similar results to ours that hemicolectomy is a better management procedure that has fewer complications than the transverse colectomy group; additionally, they showed that the hemicolectomy group experienced higher recovery, less bleeding, less anastomotic leakage, and better survival rates.

The fewer number of dissected lymph nodes in the transverse colectomy group is due to shorted size of the sample in addition to technical difficulty of performing adequate lymphadenectomy in the transverse colectomy approach.

Guan et al.<sup>15</sup> showed that a number of harvested lymph nodes were higher in the hemicolectomy group than those in the transverse colectomy group, but they stated that both procedures yielded sufficient lymph nodes for adequate staging.

Milone et al.<sup>1</sup> explained the higher complication rates after transverse colectomy is that it required both splenic and hepatic flexures mobilization which is considered a technically difficult step in any colon resection, and in transverse colectomy we required to make double mobilization of both flexures which increased risks of complications.

Regarding the follow-up, patients' outcomes, and survival rates, we showed similar results to all previous studies that both OS and DFS rates were comparable between the both procedures, suggesting that both surgical approaches were adequate, safe, and feasible for selected patients.

**Table 3:** Correlations between both included groups of patients underwent both surgical techniques regarding operative, postoperative, and outcome findings

Postoperative data	Management surgical technique						p	
	Extended right and left hemicolectomy		Transverse colectomy		Total			
	N	%	N	%	N	%		
Duration of hospital stay, days*	5 (4–8)		7 (5–9)		6 (4–9)		0.014	
	10	12.5%	4	10.0%	16	13.3%	0.963	
	18	22.5%	8	20.0%	28	23.3%		
	20	25.0%	12	30.0%	31	25.8%		
	9	22.5%	10	25.0%	26	21.7%		
	7	17.5%	6	15.0%	19	15.8%		
30-day morbidity	No	76	95.0%	38	95.0%	114	95.0%	1
	Yes	4	5.0%	2	5.0%	6	5.0%	
30-day mortality	No	78	97.5%	39	97.5%	117	97.5%	1
	Yes	2	2.5%	1	2.5%	3	2.5%	
Operative time minute*		125 (100–150)		105 (100–150)		110 (90–150)		<0.001 <sup>£</sup>
Operative complications	0	78	98.0%	36	90.0%	114	95.0%	0.002
	1	2	2.0%	4	10.0%	6	5.0%	
Postoperative complications	0	76	95.0%	34	85.0%	107	89.2%	0.017
	1	4	5.0%	6	15.0%	13	10.8%	
Relapse	No	64	80.0%	32	80.0%	96	80.0%	1
	Yes	16	20.0%	8	20.0%	24	20.0%	
Death	No	70	87.5%	36	90.0%	107	89.2%	0.917
	Yes	10	12.5%	4	10.0%	13	10.8%	

All variables were compared using Chi-square test except (\*) Mann–Whitney U-test

**Table 4:** Correlations between both included groups of patients underwent both surgical techniques regarding survival rates

Survival analysis	Total N	No events	Censored		Survival rate, %	Sig.	Survival time, months		95% confidence interval	
			N	Percent			Mean	Std. error	Lower bound	Upper bound
Relapse-free survival										
Extended right and left hemicolectomy	80	16	32	80.00%	0.8	0.587	31.15	1.537	28.137	34.163
Transverse colectomy	40	8	32	80.00%	0.8		31.15	1.537	28.137	34.163
Overall	120	24	96	80.00%	0.8		31.383	0.851	29.715	33.051
Progression-free survival										
Extended right and left hemicolectomy	80	16	32	80.00%	0.8	0.957	31.15	1.537	28.137	34.163
Transverse colectomy	40	8	32	80.00%	0.8		31.15	1.537	28.137	34.163
Overall	120	24	96	80.00%	0.8		31.383	0.851	29.715	33.051
Overall survival										
Extended right and left hemicolectomy	80	10	35	87.50%	0.875	0.984	33.325	1.128	31.115	35.535
Transverse colectomy	40	4	36	90.00%	0.895		34	0.947	32.143	35.857
Overall	120	13	107	89.20%	0.89		33.842	0.571	32.723	34.961

## SUMMARY AND CONCLUSION

In the current study, we correlate transverse colectomy and hemicolectomy whether right or left aiming at detecting the best management surgical approach and we showed that hemicolectomy is better regarding radicalism of management, better recovery, and less incidence of complications. We showed

that survival outcomes are similar between both procedures so we concluded that hemicolectomy is a better surgical approach for the management of cancer located in the mid-transverse colon regarding operative and short-term outcomes than transverse colectomy, but regarding oncological, survival, and long-term outcomes, both techniques are considered technically and oncologically safe and feasible.

## RECOMMENDATIONS

We highlighted the liability of considering transverse colectomy in certain cases of cancer in the mid-transverse colon as a safe and curative approach of managing curable transverse colon cancer rather than considering it a palliative procedure. A large study included that a large number of patients are needed to prove and strengthen our findings.

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