# Medial versus lateral approach for laparoscopic colectomy in colorectal cancer surgery

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**Background**
Colorectal cancer is considered the third common malignancy worldwide, responsible for 9% of all cancer incidences. Currently, laparoscopy is widely practiced in colorectal cancer surgery. It is related to the surgeon's experience to do either lateral-to-medial (L-M) or medial-to-lateral (M-L) approach. The two laparoscopic approaches are currently practiced, and there are conflicts of superiority of this over that and vice versa.
We aimed to show if there is any superiority of one procedure over the other regarding short-term outcomes.
**Patients and methods**
This is a prospective randomized study of laparoscopic colorectal surgery. A total of 100 patients were included in this study.
Patients were divided to two equal groups (M-L and L-M), with 50 patients each. The study was conducted from February 2017 to May 2021 in the General Surgery Department of Menoufia University Hospital.
The study endpoints were the feasibility, technical efficacy, operative time, vascular or ureteric injury, and other complications of both techniques.
We collected data according to patient demographics, technique of laparoscopic mobilization, surgery duration, hospital stay, operative and postoperative complications, and lymph node retrieval.
**Results**
A total of 100 patients with comparable demographic criteria had laparoscopic colorectal cancer surgery. Overall, 61 (61%) patients were males and 39 (39%) patients were females. A total of 50 (50%) patients underwent the M-L technique and the other 50 (50.0%) patients were operated upon using the L-M approach. Lateral approach had an average 10±3 (4–22) lymph nodes with specimen compared with 17±4 (9–31) in the medial approach. There was no statistically significant difference in the major complication rate (Clavien-Dindo IV) between the two approaches. The M-L approach showed significantly shorter operative time than the L-M approach in anterior resection and right hemicolectomy in favor of the M-L approach ($P$<0.05). The L-M approach showed a significantly higher rate of conversion to open surgery (three in the L-M approach vs. one in the M-L) and injury to the ureter and gonadal vessels ($P$<0.05). Patients in the M-L approach had a mean hospital stay of 5±1 days (range, 3–52) compared with 5±2 days (range, 3–56) in the L-M approach (not significant).
**Conclusion**
Both approaches were feasible for colon cancer surgery. The laparoscopic M-L approach was found to be technically easier and had less surgery-related complications than the L-M approach.

**Keywords:**
colorectal cancer, laparoscopic colectomy, laparoscopic medial approach for colon cancer

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## Introduction

Colorectal cancer is considered the third common malignancy worldwide, responsible for 9% of all cancer incidences [1]. The laparoscopic approach for colorectal surgery is increasing since first described in 1991 [2,3]. Compared with the open approach, the laparoscopic colorectal approach has improved the short-term outcomes, including faster recovery, decreased period of postoperative ileus, decreased wound infection incidence, decreased hospital stays, lower postoperative pain, and earlier tolerance of normal diet [3–10]. There is no difference in recurrence rates, oncological clearance, complication rates, or reoperation rates between both approaches [4,6,8,11].

This demonstrates the safety, feasibility, and short-term benefits of laparoscopic surgery.

Some authors reported that laparoscopic surgery is technically demanding, with a prolonged learning curve [12] and associated with a considerable length of operation time compared with the open approach [8].

Mobilization of the colon laparoscopically can follow one of two ways: the lateral-to-medial (L-M) approach and the medial-to-lateral (M-L) approach, which was developed by Milsom *et al.* [13,14].

The M-L approach for mesocolonic dissection was recommended by the European Association of Endoscopic Surgeons (EAES) consensus statement in 2004 [15]. However, few published studies have evaluated the comparative efficacy between the two approaches.

In the current study, we aimed to compare the M-L versus the L-M approach during laparoscopic mesocolon dissection for colon cancer regarding feasibility, technical efficacy, operative time, vascular or ureteric injury, conversion to open surgery, and other complications in both techniques.

## Patients and methods

This is a prospective comparative randomized study that was held in Menoufia University hospitals. The study was approved by the institutional review board. The study was conducted on 100 patients with colonic cancer, and it was held from February 2017 to May 2021. All patients were discussed perioperatively by consultants in a multidisciplinary meeting and proven to have colorectal cancer that is indicated for surgery. The closed envelope method was used for randomization using the double-blind technique (both patient and doctor did not know the type of approach in the chosen envelope). This research was performed at the Department of General Surgery, Menoufia University Hospitals. Ethical Committee approval and written, informed consent were obtained from all participants.

Data were collected on patient demographics, method of laparoscopic mobilization, intent of procedure, site of tumor, stage of tumor, operating time, hospital stay, conversion to open surgery, postoperative complications, and lymph node retrieval.

Participants were followed up for 1 year.

### Inclusion criteria

Patients aged 18–70 years old with confirmed colorectal cancer diagnosis by histopathology and had laparoscopic surgery with curative intent were included.

### Exclusion criteria

The following were the exclusion criteria:

Those younger than 18 years or older than 70 years.

Those undergoing noncancer resections, open operations, or completion surgery or palliative procedures.

Those with locally advanced or metastatic tumors.

Those with advanced comorbidities.

Those with previous abdominal surgery with hostile abdomen.

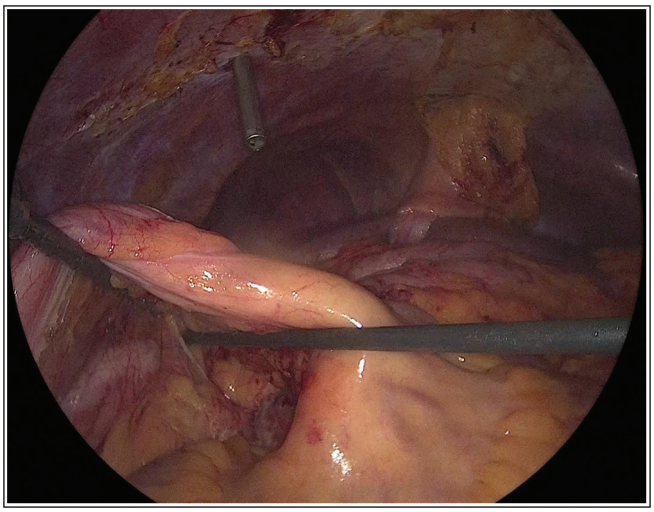
### Surgical technique

All patients underwent laparoscopic surgery of the colorectal cancer and the colon was initially mobilized either laterally or medially. In M-L group, a mesenteric window is opened using cautery, and blunt dissection is used to separate the congenital fusion plane between the mesentery and the retroperitoneum. In contrary, in the L-M group, dissection started at the white line of Toldt. All patients had stapled intracorporeal ileocolic, colorectal anastomosis, or terminal colostomy. Handsewn sutures were sometimes used for completion of the stapled intracorporeal anastomosis. Illustrative figures are shown in Figs 1–7.

### Data analysis

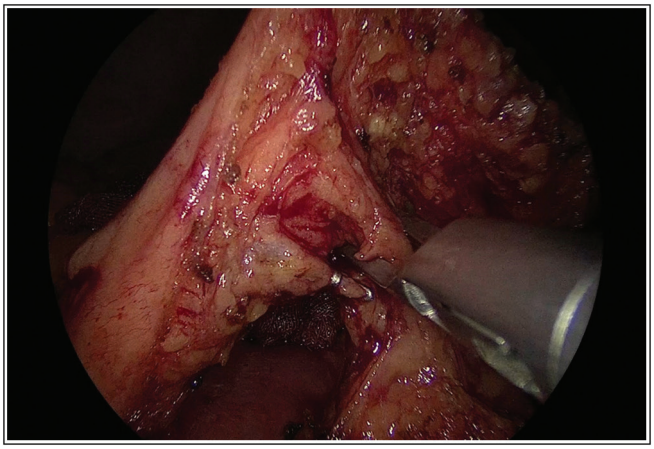
Data were analyzed using SPSS 24.0 (IBM SPSS Inc., Armonk, New York, USA). Comparisons between groups

**Figure 1**



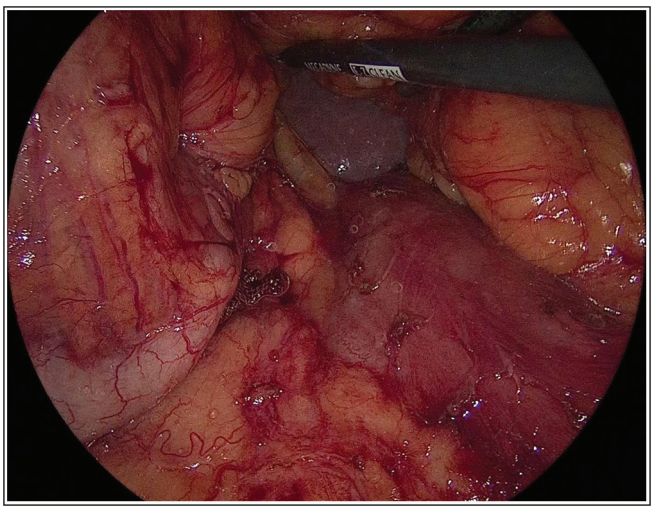
Medial dissection of the right mesocolon.

**Figure 2**



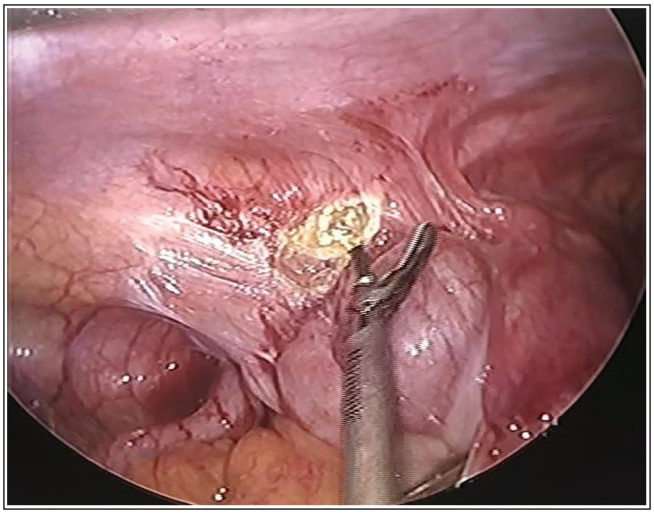
Control of the right ileocolic vessels.

**Figure 3**



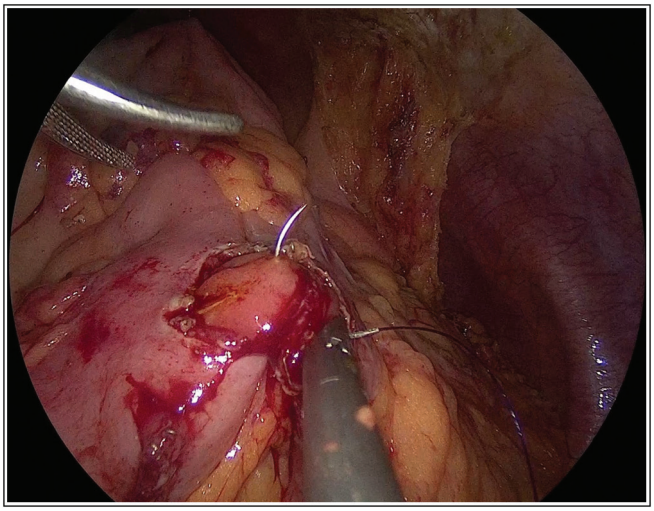
The duodenum is located behind the retro-meso colic space in the M-L approach. M-L, medial-to-lateral.

**Figure 4**



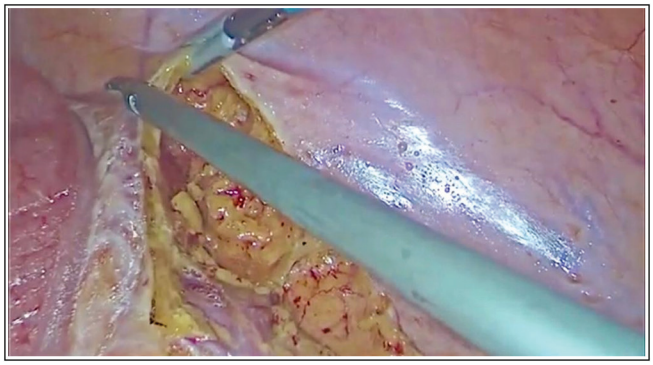
Adhesions in the L-M approach in right hemicolectomy. L-M, lateral-to-medial.

**Figure 5**



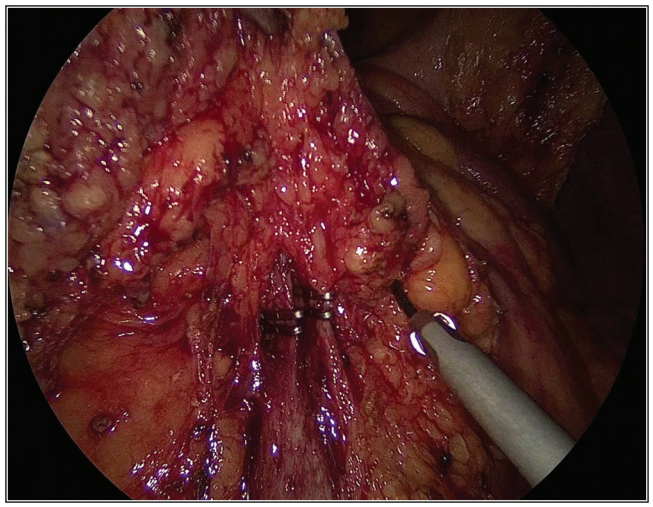
Ileocolic anastomosis.

**Figure 6**



Lateral approach in left hemicolectomy.

**Figure 7**



Control of the middle colic vessels.

were made using $\chi^2$ test or Fisher's exact test as appropriate. Results were extrapolated in a Box and Whisker plot. *P* value less than 0.05 was considered significant.

## Results

A total of 100 patients had laparoscopic colonic resection during the study period.

Overall, 61 (61%) were males, with a mean age of 55 ± 4 years (range, 33–70 years) (Tables 1 and 2). A total of 50 (50.0%) patients had surgery with M-L approach and 50 (50.0%) had L-M approach. Overall, 63 (63%) patients had left-sided surgery and 37 (37%) patients underwent right-sided surgery.

### Operative time

The mean duration of right hemicolectomy (37) in the M-L group was 186 ± 18 (95–195) minutes, whereas in the L-M group was 217 ± 26 (118–285) (Table 3). Left hemicolectomy (33) took 190 ± 17 (130–310) minutes in the M-L group compared with 200 ± 19 (183–265) minutes in the L-M (*P*<0.05). The mean operative time of anterior resections (30) was 220 ± 27 (150–355) minutes in the M-L group compared with 245 ± 29 (160–340) minutes in the L-M group (*P*>0.05).

### The number of working and assistant ports

Three to four ports were used in the M-L group with a mean of 3 ± 1, whereas four to six ports were required in the L-M groups, with a mean of 4 ± 1. (*P*<0.05).

No significant differences were identified between the two groups regarding age, but there was male predominance among patients (*P*<0.05). However, there was no significant difference in the type of approach in both sexes (*P*<0.05).

### Lymph node retrieval

The mean number of LNs dissected in the M-L group was 17 ± 4 (9–31) compared with 10 ± 3 (4–22) in the L-M group. There was significant difference between the two groups (*P*<0.05).

### Complications

Individual complication rates are summarized in Table 4. Two (4%) patients had wound infection in the M-L group compared with three (6%) patients in the L-M group. One (2%) patient in the M-L and similarly one (2%) patient within the L-M group had an anastomotic leak. One (2%) patient within the M-L group required reoperation, whereas two (4%) patients had reoperations within the L-M group. One (2%) patient underwent conversion to open surgery in the M-L group, whereas three (6%) patients underwent conversion to open surgery in the L-M group.

There were statistically significant higher complications in the L-M approach. Delayed bowel movement, ureteric injury, conversion to open surgery, and operative bleeding (injury to gonadal vessels) were more evident in the L-M groups (*P*<0.05) (Table 4). Postoperative complications were classified according to the Clavien-Dindo classification (Table 5). There was a statistically significant difference in grades I, II, and III complications, and no mortalities or major complications were reported in either group.

### Hospital stay

Patients in both groups had similar hospital stay. Patients in the M-L group had a mean length of stay of 5 ± 1 days (range, 3–52) compared with 5 ± 2 days (range, 3–56) in the L-M group.

**Table 1 Patient characteristics**

| | Total | Medial | Lateral | *P* |
|---|---|---|---|---|
| Total | 100 | 50 | 50 | NS |
| Male | 61 | 28 | 33 | NS |
| Female | 39 | 22 | 17 | NS |

**Table 2 Operative details**

| Procedure | Total number | Medial | Lateral |
|---|---|---|---|
| Right hemicolectomy | 37 | 19 | 18 |
| Left hemicolectomy | 33 | 17 | 16 |
| Anterior resection | 30 | 14 | 16 |

## Discussion

Colorectal surgery is an everyday practice worldwide. As a minimally access surgery, laparoscopic colorectal surgery is associated with less postoperative pain, early oral diet tolerance, decreased postoperative ileus, and faster recovery. Compared with open surgery, laparoscopic colorectal surgery is technically challenging, needs a long learning curve, requires

**Table 3 Operating times and number of ports**

| Procedure | M-L op time (min) | L-M op time (min) | *P* |
|---|---|---|---|
| Right hemicolectomy | 186 ± 18 (95–195) | 217 ± 26 (118–285) | <0.05 |
| Left hemicolectomy | 190 ± 17 (130–310) | 200 ± 19 (183–265) | >0.05 |
| Anterior resection | 220 ± 27 (150–355) | 245 ± 29(160–340) | >0.05 |
| Number of ports | 3–4 | 4–5 | <0.05 |

L-M, lateral-to-medial; M-L, medial-to-lateral.

**Table 4 Complications**

| | M-L [*n* (%)] | | L-M [*n* (%)] | | *P* |
|---|---|---|---|---|---|
| Wound complications | 2 (4) | | 3 (6) | | NS |
| Reoperation | 1 (2) | | 2 (4) | | NS |
| Anastomotic leak | 1 (2) | | 1 (2) | | NS |
| Ileus | 2 (4) | | 4 (8) | | <0.05 |
| Conversion to open approach | 1 (2) | | 3 (6) | | <0.05 |
| Postoperative death | 0 | | 0 | | – |
| Injury to gonadal vessels (Bleeding) | 0 | | 3 (6) | | <0.05 |
| Injury to the ureter | 0 | | 1 (2) | | <0.05 |
| | Mean | Range | Mean | Range | |
| Length of stay (days) | 5±1 | (3–52) | 5±2 | (3–56) | NS |

L-M, lateral-to-medial; M-L, medial-to-lateral.

**Table 5 Clavien-Dindo grading of complications**

| Grade | Medial [*n* (%)] | Lateral [*n* (%)] | *P* |
|---|---|---|---|
| I | 4 (8) | 6 (12) | <0.05 |
| II | 5 (10) | 7 (14) | <0.05 |
| III | 1 (2) | 3 (6) | <0.05 |
| IV | 0 | 0 | – |
| V | 0 | 0 | – |

special equipment, and has expensive consumables. These potential obstacles make surgeons reluctant to adopt laparoscopic colorectal techniques. Studies did not find superiority of open surgery regarding overall survival, oncological clearance, rate of recurrence, complication rates, and reoperation rate [11]. Two laparoscopic approaches are practiced nowadays, and there are conflicts of preference of one over the other.

In the present study, we found that the intraoperative bleeding and the rate of conversion to open surgery were significantly higher in the L-M group ($P$<0.05) (Table 4).

There was no significant difference regarding anastomotic leak and wound infection.

In addition, no statistically significant difference was found regarding operative time between the two approaches, except for M-L right hemicolectomy, where it had significantly shorter operative time ($P$<0.05) (Table 3) Additionally, there was a significant difference in the number of the retrieved lymph nodes in favor of the M-L group ($P$<0.05). The increased number of retrieved lymph nodes in favor of the M-L group expresses a better mesocolonic nodal clearance and a better curability and low rate of recurrence.

A meta-analysis by Ding and colleagues demonstrated increased benefits for M-L approach by studying five cohort studies including two randomized control trials and three retrospective studies including 881 patients [16–20]. They reported a lower conversion rate for the M-L group, as well as significantly shorter operative duration and lower blood loss, although this approach led to fewer retrieved lymph nodes. Moreover, rates for postoperative complications, wound infection, anastomotic leak, recurrence, and mortality as well as length of hospitalization were not significantly different between the two approaches. The reasons for an increased conversion rate in the present study include adhesions, which were greater on the lateral side owing to diverticulitis in the left side and previous appendicitis in the right side. So, the risk of injury to retroperitoneal structures becomes higher. M-L approach may allow early identification of the mesocolonic-retroperitoneal plane, with reduced blood loss. Another disadvantage of the L-M approach includes higher redundancy of the colon, where manipulation of the colon becomes more difficult where a need to use an extra assistant port in most cases was required. The lateral peritoneal attachment makes the medial mesenteric dissection easier by applying counter-traction by the operating surgeon with no need to add an assistant port to pull the colon. Again, we agree with Seif El-Deen *et al.* [21] that early control of the vascular pedicles can reduce bleeding and postoperative complications. Hussain *et al.* [22] reported no significant difference in their retrospective study. On the contrary, we found that the postoperative ileus was lesser in favor of the M-L group ($P$<0.05). One more benefit of the M-L approach in the present study is that it allows early vascular control and peeling of the lymph node away from the inferior mesenteric artery and the ileocolic artery; hence, the incomplete clearance may decrease the survival and increase the possibility of metastasis and cancer recurrences. Earlier identification of the ureter and vessels of the gonads – during M-L approach – prevented their injury and intraoperative bleeding. On the contrary, two patients in the present study experienced injury to the gonadal vessels on either side during the L-M. We followed up those patients for 6 months and found no decrease in the testicular size or vascularity by ultrasound and MRI. The present study encourages more application of M-L

approach in laparoscopic colorectal cancer surgery and more studies are needed from our colleagues to build solid evidence about the superiority of one technique over the other.

## Conclusion

Laparoscopic M-L and L-M approaches are successful in mesocolonic resection during colorectal cancers. Laparoscopic M-L approach was found to be safer, achieved more mesocolonic lymph node retrieval, and had less surgery-related complications than the L-M approach. More studies are required from our colleagues to build solid evidence of the efficiency, safety, and superiority of one approach over the other for laparoscopic colorectal cancer surgery.

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Declarations: The study was approved by our institution review board.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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