Medial to lateral VS lateral to medial in laparoscopic right hemicolecotomy-are both techniques the same?

Danny Hazan (dannyhazan2003@yahoo.com)  
The Edith Wolfson Medical Center

Arkadi Ishakov  
The Edith Wolfson Medical Center

Sammy Levi  
The Edith Wolfson Medical Center

mordechai shimonov  
The Edith Wolfson Medical Center

katia dayan  
The Edith Wolfson Medical Center

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Abstract

Purpose

we compare MtL to LtM surgical approach for laparoscopic right hemoilectomy, with regards to number of lymph node harvested, operation duration, and length of hospitalization (LOH).

Methods

A retrospective analysis of patients who underwent laparoscopic right hemoilectomy resections for malignant neoplasms, curative-intent, between 2013 to 2020 at Edith Wolfson Medical Center. Surgical techniques were defined as Medial to lateral if the first stage included blood vessel ligation. Lateral to Medial was defined if the first step included mobilization of the lateral attachments.

Results

133 patients who were diagnosed with colon cancer (mean age 72 ± 5.8 years, 46% males) were selected for laparoscopic right hemoilectomy. 54 were treated with the MtL approach, and 79 were treated with the LtM approach. Lymph nodes harvested were similar between the 2 groups (mean of 17, SD +-11). LOH and time of first flatulence were similar between the groups (11.78 ± 1.8 for the LtM group vs. 10.56 ± 1.4 for the MtL group for LOH, and 3.75 ± 0.8 days for the LtM group vs. 4 ± 0.9 days for the MtL group for time of first flatulence, p = 0.30 and p = 0.69 respectively). No difference in patient's survival rate within 30 days. Patients after LtM approach had a shorter operation time (2.18H).

Conclusion

The laparoscopic approach performing right hemoilectomy resection can be performed safely with the same results using the two methods compared. It showed no oncological benefits, and no significant differences in the LOH or short term survival. The LtM approach was associated with a shorter surgery time.

Introduction

According to World Health Organization, colorectal cancer (CRC) is the third most common form of cancer worldwide, accounting for 9.4% of all cancer cases in men, and 10.1% of cancer cases in women (2, 3). Most cases are diagnosed between the 6th and 7th decade of life with a rising incidence in younger people, and right-sided colon cancers represent nearly one-third of all cases of colonic malignancies (3). Colorectal cancer survival is highly dependent upon pathological staging with respect to the number of lymph nodes harvested during operation (4, 8).
Right-sided CRC patients tend to have advanced and bigger tumors, which are often poorly differentiated. Compared to left sided CRC, which have polypoid morphology that is easier to detect during colonoscopy, right-sided tumors show sessile serrated adenomas or mucinous adenocarcinomas, flat morphology that is difficult to detect (10). Several studies in recent years have shown that patients with colon cancers on the right side have worse short- and long-term survival rates than those with left-sided tumors regardless of the stage of the disease at diagnosis or the nature of treatment (11).

For years the consensus among professional surgical and cancer treatment societies has held that, at a minimum, 12 lymph nodes should be removed and analyzed to determine the prognosis and treatment of patients with colon cancer. The ACS Commission on Cancer (CoC) has identified this standard as a quality performance indicator for surgical treatment (12, 30).

Surgical resection is the mainstay of treatment. Minimally invasive surgeries for colon and rectal resections have resulted in earlier tolerance of diet, accelerated return of bowel function, lower analgesic requirements, and shorter length of hospital stay compared with open surgery. Large multicenter randomized trials have also shown comparable disease-free and overall survival between open and laparoscopic approaches for colon cancer (7, 8, 15).

Historically open right colectomy was performed by the lateral to medial (LtM) approach. The classical "open technique" that was imitated by the laparoscopic surgeons was also LtM. This technique was debated by Turnbull et al. (9) claiming that maneuvering of malignant neoplasm before ligation of vascular pedicle might lead to tumor cell dissemination, while "ligation first" carries improved survival rates (9). Poon and Wiggers et al. (3, 12) suggested that the MtL dissection results in an increased number of lymph nodes harvested relative to the LtM approach in patients undergoing right colectomy for neoplasia.

A randomized trial comparing "no to touch" resection with conventional surgery during open resection has failed to show similar results (13). The trend of MtL had gained popularity and, in 2004, the European Association of Endoscopic Surgeons (EAES) consensus recommended a medial-to-lateral approach for mesocolic dissection (14). However, few studies have subsequently been published evaluating the comparative efficacy between the two approaches and contribute to the evidence base for this approach. Fei Li et al.'s (16) large systemic review found no differences between MtL or LtM regarding safety, while other parameters evaluated such as the postoperative flatus recovery time and hospitalization time of LtM approach were shorter compared with MtL approach. Garth et al. reported similar results in a comparison of the two techniques in performing da Vinci-assisted laparoscopic right hemicolecctiony.

The logic behind the recommendations of this technique (MtL) was that the division and ligation of the mesenteric vessels allow for a better oncologic resection and higher number of lymph nodes harvested (3, 4, 8, 17).

However, some reports have found no difference in performing the LtM approach compared to the MtL approach mentioned above (3, 7, 16, 17).
Ongoing debate exists regarding which is the best laparoscopic technique in terms of oncologic results (margins status, lymph nodes harvested), morbidity, LOH and duration of surgery.

In the present study, we aim to compare the medial-to-lateral versus lateral-to-medial approach during laparoscopic right hemicolectomy in terms of short term overall survival, operating time, circumferential resection margin (CRM) clearance, lymph node harvest, complications and length of postoperative hospital stay.

**Materials And Methods**

A retrospective cohort review was obtained from medical charts. The study was approved by the local IRB; with no informed consent needed because of the retrospective non-interventional study design. Patients were identified according to the ICD-9 code and data were extracted from the central EMMS hospital archive section.

Included in the analysis were all adult patients undergoing laparoscopic right hemicolectomy as a result of a previous diagnosis of cancer in the cecum, ascending colon, or hepatic flexure of the colon. All surgeries took place between 2013 and 2020 at Edith Wolfson Medical Center, a tertiary teaching hospital.

All patients were evaluated pre-operatively by a multidisciplinary team including a surgeon, an oncologist, a pathologist and a radiologist. All operations were performed by experienced laparoscopic colorectal surgeons which completed the learning curve on each approach.

We excluded any patients that were under 18 years old who underwent, non-cancer resections or open operations. Additionally, cases in which the surgical technique was not clearly reported, when hand assisted technique was used, or metastasis was diagnosed during laparoscopy were excluded.

The surgical approaches were discussed in length earlier in the article elsewhere (1–3). In brief, for the medial to lateral approach (MtL), the first step included ligation of the ileocolic artery and subsequent medial to lateral dissection of the mesocolon from the retro peritoneum. After the dissection was completed, the lateral attachments of the right colon are released and the hepatic flexure and proximal transverse colon were mobilized.

For the lateral to medial approach (LtM), the lateral attachments were first mobilized along with the hepatic flexure and proximal transverse colon. The specimen was en block exteriorized and the ileocolic artery ligation and mesocolon dissection were performed.

An extracorporeal stapled anastomosis was constructed in both techniques and either technique close routinely the mesenteric defect.

Patients were operated in either technique depending on the surgical colorectal unit preference, while unit A performed the LtM approach and unit B performed the MtL approach routinely.
Allocation of patients: Each of the surgical approaches for laparoscopic hemicolecotomy (either MtL or LtM) was practiced routinely and solely by a specific colorectal surgical team in the hospital (unit A performing the LtM approach and unit B performing the MtL approach). Patients were referred to each of the units based on the date of colonoscopy diagnosis, when a specific unit was on call. Some of the patients were admitted electively while others were transferred from the internal medicine departments after a diagnostic workup for melena or rectal bleeding. All patients had the same postoperative care in both groups during the whole study periods.

This study analyzed the following data: patient's demographic, age and gender, emergency or elective admission, BMI, length of hospital stay, length of stay after surgery, patient's comorbidities, laboratory test results, and the colonoscopy report. Operative data included laparoscopic technique, operation duration and postoperative outcome and complication classification were recorded. Pathologic evaluation was performed by two pathologists, specialized in colorectal pathology. The pathologists were blinded to the laparoscopic technique. Pathological results recorded included number of lymph nodes (LN) harvested, margins status and tumor differentiation.

Data were analyzed using SPSS version 25.0 software (IBM Corp, Armonk, NY, USA). All P values were two-sided, and the significant level was specified as P < 0.05 in all analyses. Summary statistics are presented as mean values with standard deviation. The Chi-Square tests, Pearson correlation, In depended sample T test, as statistical tests.

Results

During the study period, 133 patients who underwent laparoscopic right hemicolecotomy were eligible to be included in this study. The MtL approach was used in 54 cases, while the LtM approach was used in the other 79 cases. The mean age for patients was 72 ± 5.8 years, 46.6% males and 53.4% females. Demographical variables, comorbidities, symptoms and baseline laboratory data are presented in Table 1.

The most common symptom of CRC was weight loss, which was documented in 33% of the total cases, without clinical significant between the groups. No association was documented between the presence of diabetes mellitus or cardiovascular comorbidities and postoperative complications. However, anemia was found to be associated with occult blood prior to surgery, where 81.5% of the MtL group had anemia after occult blood with clinical significant, p < 0.004 and 18.8% of the LtM group had the same anemia after occult blood correlation, p < 0.05. No mortalities were recorded in the 30 days postoperative period in either group.

When comparing the median number of lymph nodes harvested, both groups demonstrated the similar numbers (Table 2).

LOH and time of first flatulence were similar between the groups (11.78 ± 1.8 for the LtM group vs. 10.56 ± 1.4 for the MtL group for LOH, and 3.75 ± 0.8 days for the LtM group Vs. 4 ± 0.9 days for the MtL group
for time of first flatulence, \( p = 0.30 \) and \( p = 0.69 \) respectively).

Operating time was significantly lower in the LtM group compared to the MtL group 138 ± 43min to 180 ± 27min, \( P > 0.001 \).

Circumferential margin (CRM) was negative in all specimens and the pathological tumor staging was similar between the two groups, T2 (33.6%) T1 (22%) T3 (35%) for the LtM group vs. T2 (33.6%) T1 (22%) T3 (35%) for the MtL group, \( p = 0.320 \). \( P = 782 \) and \( p = 480 \) respectively. N0 (68.6%), N1(24.1%) and N2a(7.4%) for the MtL groups Vs N0 (72.1%), N1(21.6%) and N2a(6.3%) for the LtM groups, \( p = 0.490 \). \( P = 280 \) and \( p = 320 \) respectively.

Complication rates are summarized in Table 3. No statistically difference was observed between the groups regarding wound infection, surgical site infection (SSI) in the postoperative period was mild and managed conservatively, atelectasis or urine incontinence in both groups. None of groups had an anastomotic leak or required a reoperation. Ileus occurred in 4 (7.4%) patients in the medial-to-lateral group compared to 6 (7.5%) patients in the lateral-to-medial group. No statistically significant differences were detected regarding individual complications and no deaths were reported within 30 days of the operations.

We classified the postoperative complications according to the Clavien-Dindo classification (Table 2). There was no statistically significant difference in the major complication rate (Clavien-Dindo IV) between the groups or on minor complications (Clavien-Dindo II and I).

There were no intra-operative complications, associate injury or postoperative complications in any of the groups, and there were no deaths within 30 days of operation.

**Discussion**

We demonstrated that the LtM surgical approach in laparoscopic right hemicolectomy is as safe and effective as the MtL, when comparing the lymph node harvesting, LOH and time to first flatulence. We also documented shorter length of surgery with the LtM approach, but this did not affect the prognosis or complications rates.

The ideal operation technique can be evaluated regarding 5 parameters: number of lymph nodes harvested, length of hospital stay, operation time, complication rate and return of bowel function (flatus). The removal of at least 12 lymph nodes following colorectal resection is the acceptable minimum of lymph node harvesting (17, 18, 27). Each of the techniques evaluated in our study achieved a sufficient number of lymph nodes harvested (17 lymph nodes) which is above the current recommendation (2, 3, 24, 28).
Ballantyne et al. (19, 28) reported that in a telerobotic-assisted laparoscopic right colectomy series 12 lymph nodes were harvested in MtL or LtM technique. Similar results of 16 lymph nodes were reported by Liang JT et al. (20) in a randomized clinical trial comparing those two techniques. In a large meta-analysis of the two techniques, Hajibandeh et al. (21, 27) did not find any difference in lymph nodes harvested between the aforementioned techniques. There is no doubt about the positive predictive value of the number of lymph nodes harvested and prognosis, or improved survival (7, 23, 28), however, our results emphasize that from an oncologic point of view the LtM technique is as good as the MtL technique.

In our study, we did not find any difference in length of hospitalization (LOH) between the two groups. LOH were similar between the groups 11.78 ± 1.8 for the LtM group vs. 10.56 ± 1.4 for the MtL group, with no significant statistical difference. However, because of the diversity of elective and semi-elective patients, we measured hospitalization time from surgery to discharge 5.1+-2.4 for the LtM group vs. 5.3+-2.2 for the MtL group, with no significant statistical difference.

West et al. reported a mean hospital stay of 8.5 ± 1.2 days (13) and international studies by Maher et al. and Senagore & Delaney report a mean of 6 days (11, 12) in patients who underwent laparoscopic colonic procedures. In their prospective nonrandomized study of 248 patients undergoing laparoscopic colon resection versus open colon resection, Lezoche et al. found that mean length of hospital stay was 9.2 days for laparoscopic right hemicolectomy and 13.2 days for open right hemicolecotomy (22). Our results are comparable to the reports in the literature when measuring length of hospitalization after surgery.

Regarding operation times, Hajibandeh et al. (21, 25, 27) demonstrated shorter operative times with MtL approach and lower rates of conversion from laparoscopic surgery to open surgery than our study. Same results were reported by Nicola et al. (25) however in 5 articles analyzed by Fei et al. (16, 23) no difference was found between the two techniques. We documented significantly shorter operation time with the LtM approach, a reduction of about 30–40 minutes on average, but with no statistical significance (p = < 0.005).

As this study had only 54 MtL procedures compared to 79 LtM procedures, it may have been insufficient numbers to detect any meaningful differences. We did not see any differences in complication rate, anastomotic leaks, wound infections as was demonstrated in other reports (26, 27, 28).

The present study documented only few cases of surgical site infection as the only morbidities, these results matched to the trial done by Fabozzi et al.(29) who reported no postoperative complication in his subjects.

Return of bowel function was measured by time to first flatus. Fei et al. (16) revealed that in the LtM approach time to flatulence was shorter than other approach, same results were observed by Fei et al. (16). Nicola et al. (25) in measuring bowel sounds in laparoscopic left colectomies found shorter periods with the MtL approach while no differences were observed in laparoscopic right colectomies. In our study,
we did not find any clinical relation between the two groups, but we did find correlation with the length of hospital stay with clinical significant > 0.005 which indicates that the longer it takes for the patient to pass gas, the longer the hospital stay.

As a retrospective study, our study has some limitations. The possibility of selection bias is always present and difficult to assess accurately. Additionally, our sample size was relatively small which may reduce the accuracy of our results.

There were no long-term prognosis information or cancer cure rates available. Longer follow-up and larger prospective randomized trials have to be validated in an attempt to decide which is the ideal technique for laparoscopic right colectomy.

**Conclusion**

We conclude that the Lateral to Medial approach is as efficient and safe as the Medial to Lateral approach in laparoscopic right hemicolecctionomy. There were no oncological or general short-term benefits observed with either approach, or differences in complication and LOH. In our study, the LtM approach was associated with shorter operative time, although we found no meaningful consequences related to this time difference in terms of postoperative results. We believe that according to our results each surgeon has to evaluate his results and, to choose his preferred technique.

**Declarations**

**Conflict of interest:**

The authors declare that they have no conflict of interest.

**Compliance with ethical standards**

**Funding**

There was no funding for this study.

**Author's contribution:**

Danny Hazan- Idea and writing

Arkadi Ishakov- tables

Sammy Levi- review

Mordechi Shimonov review

Katia Dayan- review


Tables
### Table 1- Demographic data of the study population

<table>
<thead>
<tr>
<th></th>
<th>MtL group</th>
<th>LtM group</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=54</td>
<td>N=79</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>70.60+/13.6</td>
<td>73.26+/13.9</td>
<td>0.280</td>
</tr>
<tr>
<td>BMI</td>
<td>27.7+/1.5</td>
<td>28.0+/1.7</td>
<td>0.690</td>
</tr>
<tr>
<td>Gender</td>
<td>M-(28)51.8%</td>
<td>M-(40)50.6%</td>
<td>0.420</td>
</tr>
<tr>
<td></td>
<td>F-(26)48.1%</td>
<td>F-(39)49.4%</td>
<td>0.400</td>
</tr>
<tr>
<td>Comorbidity%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coagulation Tx</td>
<td>(41)75.9%</td>
<td>(60)75.9%</td>
<td>0.786</td>
</tr>
<tr>
<td>Heart</td>
<td>(35)64.8%</td>
<td>(53)67%</td>
<td>0.450</td>
</tr>
<tr>
<td>DM</td>
<td>(29)53.7%</td>
<td>(50)63.3%</td>
<td>0.640</td>
</tr>
<tr>
<td>HTN</td>
<td>(48)89%</td>
<td>(70)88.6%</td>
<td>0.380</td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>(2)3.7%</td>
<td>(3)3.7%</td>
<td>0.540</td>
</tr>
<tr>
<td>Symptoms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weakness</td>
<td>(18)33.1%</td>
<td>(27)33%</td>
<td>0.640</td>
</tr>
<tr>
<td>Bleeding</td>
<td>(7)12.9%</td>
<td>(9)11.4%</td>
<td>0.420</td>
</tr>
<tr>
<td>Weight loss</td>
<td>(16)29.6%</td>
<td>(24)30%</td>
<td>0.320</td>
</tr>
<tr>
<td>Pain</td>
<td>(3)5.5%</td>
<td>(5)6.3%</td>
<td>0.780</td>
</tr>
<tr>
<td>Anemia</td>
<td>(44)81.5%</td>
<td>(15)18.8%</td>
<td>0.040</td>
</tr>
</tbody>
</table>

Note: within each dependent measure, means with different means with clinical significant of >0.05, Tx-Treatment

### Table 2- Operation results of the study groups
<table>
<thead>
<tr>
<th></th>
<th>MtL group</th>
<th>LtM group</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean LN harvest(range)</td>
<td>17.5(5-11)</td>
<td>17.65(2-22)</td>
<td>0.450</td>
</tr>
<tr>
<td>Distribution of T according to TMN classification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 (submucosa)</td>
<td>(12) 22%</td>
<td>(17) 22%</td>
<td>0.782</td>
</tr>
<tr>
<td>T2 (muscularis)</td>
<td>(17.9) 33.6%</td>
<td>(26.5) 33.6%</td>
<td>0.320</td>
</tr>
<tr>
<td>T3 (all wall +peri-colic fat)</td>
<td>(19) 35%</td>
<td>(27) 35%</td>
<td>0.480</td>
</tr>
<tr>
<td>*CRM</td>
<td>negative</td>
<td>negative</td>
<td>negative</td>
</tr>
<tr>
<td>Distribution of N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>(37) 68.6%</td>
<td>(57) 72.1%</td>
<td>0.490</td>
</tr>
<tr>
<td>1</td>
<td>(13) 24.1%</td>
<td>(17) 21.6%</td>
<td>0.280</td>
</tr>
<tr>
<td>2a</td>
<td>(4) 7.4%</td>
<td>(5) 6.3%</td>
<td>0.320</td>
</tr>
<tr>
<td>Length of Operation (minutes)</td>
<td>180 ± 27</td>
<td>138 ± 43</td>
<td>0.001</td>
</tr>
<tr>
<td>Length of Hospitalization (days)</td>
<td>10.56±1.4</td>
<td>11.78±1.8</td>
<td>0.690</td>
</tr>
<tr>
<td>Length of Hospitalization from Surgery (days)</td>
<td>5.3±2.2</td>
<td>5.1±2.4</td>
<td>0.720</td>
</tr>
<tr>
<td>Time to Flatus (days)</td>
<td>3.75±0.8</td>
<td>4±0.9</td>
<td>0.300</td>
</tr>
<tr>
<td>Clavien Dindo Classification</td>
<td></td>
<td></td>
<td>0.540</td>
</tr>
<tr>
<td>I</td>
<td>(4) 7.4%</td>
<td>(5) 6.3%</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>(3) 5.5</td>
<td>(4) 5.1%</td>
<td></td>
</tr>
<tr>
<td>III,IV</td>
<td>(0) 0</td>
<td>(0) 0</td>
<td></td>
</tr>
</tbody>
</table>

Note: within each dependent measure, means with different with clinical significant of >0.05

Table 3- Complications
<table>
<thead>
<tr>
<th></th>
<th>MtL group (N=54)</th>
<th>LtM group (N=79)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound infection</td>
<td>4 (7.4%)</td>
<td>5 (6.3%)</td>
<td>0.890</td>
</tr>
<tr>
<td>Re-operation</td>
<td>0</td>
<td>0</td>
<td>n/s</td>
</tr>
<tr>
<td>Leakage</td>
<td>0</td>
<td>0</td>
<td>n/s</td>
</tr>
<tr>
<td>Ileus</td>
<td>4 (7.4%)</td>
<td>6 (7.5%)</td>
<td>0.730</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>1 (1.85%)</td>
<td>1 (1.3%)</td>
<td>0.420</td>
</tr>
<tr>
<td>Urine incontinence</td>
<td>1 (1.85%)</td>
<td>1 (1.3%)</td>
<td>0.420</td>
</tr>
<tr>
<td>Death</td>
<td>0</td>
<td>0</td>
<td>n/s</td>
</tr>
</tbody>
</table>

Note: within each dependent measure, means with different clinical significance of >0.05.