Comparison of Short- and Long-term Outcomes of Laparoscopic and Open Right Hemicolectomy for Colon Cancer

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ABSTRACT:

Introduction: Colorectal cancer is still among the most common malignancies in the world.

Aim: The aim of this study is to compare the outcomes of open and laparoscopic right hemoctectomy for colon cancer.

Materials and methods: This retrospective study included 87 patients who underwent laparoscopic and open right hemicolectomy for colon cancer between January 2014 and January 2020. Patients were categorized into two groups according to the surgical technique: laparoscopic (46 cases) and open (41 cases). Patient characteristics and clinicopathological findings, surgical findings, short- and long-term results were included in the evaluation parameters. Patients with pathological diagnosis other than adenocarcinoma, distant metastases, and incomplete file datas were excluded from the study.

Results: Forty-six (52.9%) patients underwent laparoscopic and 41 (47.1%) patients underwent open right hemicolectomy. The operation time of the laparoscopic group was found to be significantly higher (P<0.001). The amount of blood loss was significantly higher in the open group (P < 0.001). The incidence of post-operative complications in the open group (26.8%) was higher than in the laparoscopic group (6.5%) (P = 0.010). The rate of anastomotic leakage (9.8%) was higher in patients who underwent open surgery compared to laparoscopic group (0%) (P = 0.045). It was found that the laparoscopic group had a shorter hospital stay (P = 0.009). No statistically significant differences were found between the groups in terms of overall survival (OS) rate (P = 0.400) and disease-free survival (DFS) rate (P = 0.781).

Conclusion: Laparoscopic right hemoctectomy for colon cancer is a feasible and reliable method with lower postoperative morbidity and similar long-term results to the open method.

KEYWORDS: colon cancer, laparoscopy, open surgery, right hemoctectomy, survival

ABBREVIATIONS

ASA – American Society of Anesthesiologists
CI – confidence interval
COPD – chronic obstructive pulmonary disease
DFS – disease-free survival
ICU – intensive care unit
OS – overall survival
SD – standard deviation

INTRODUCTION

Colorectal cancer is still among the most common malignancies in the world. Although the first laparoscopic colon resection was performed in 1991, it was not widely used for a long time due to some technical problems and oncological concerns [1]. However, since 2004, laparoscopic colon resection has again become a common operation [2]. Studies such as COST, COLOR, and CLASSIC have shown that minimally invasive surgery for malignant neoplasms of the colon has comparable outcomes to traditional open colectomy [3, 4]. In many studies, it has been stated that laparoscopic surgery has many advantages such as less postoperative pain, less blood loss, shorter hospital stay, faster recovery of bowel movements compared to traditional open surgery [5]. However, factors such as longer operation time in laparoscopic colon surgery, deterioration of the circulatory and respiratory system by CO2 pneumoperitoneum are among the disadvantages. Laparoscopic surgery is more commonly used in many centers, especially in left colon and rectum tumors. On the other hand, in right colon cancers, laparoscopic technique is more difficult and the procedure can be done easily with an open method and small incisions, therefore laparoscopy is relatively less preferred and continues to be a matter of discussion.

AIM

The aim of this study is to discuss the feasibility and safety of laparoscopic right hemoctectomy in patients with right-sided colon cancer, and to evaluate the short and long-term results after surgery.

MATERIALS AND METHODS

This retrospective study included 87 patients who underwent laparoscopic and open right hemicolectomy for right-sided colon cancer in the Surgical Oncology Clinic between January 2014 and January 2020. The data of the patients were reviewed retrospectively. Patients undergoing right hemoctectomy were categorized into two...
groups according to the surgical technique: laparoscopic (46 cases) and open (41 cases). The inclusion criteria were: preoperative diagnosis of histologically proven right colon adenocarcinoma, having undergone open or laparoscopic right hemicolectomy, complete file records, and absence of distant metastases. Patients with pathological diagnosis other than adenocarcinoma, distant metastases, and incomplete file records were excluded from the study.

Patient characteristics and clinicopathological findings, surgical findings, short- and long-term results were included in the evaluation parameters. Age, gender, American Society of Anesthesiologists (ASA) score, comorbidity, and pathological stage were evaluated in patient characteristics and clinicopathological findings. The extent of resection, anastomosis method, operation time (min), amount of bleeding (mL), number of retrieved lymph nodes and number of metastatic lymph nodes were evaluated as surgical findings. As short-term outcomes, postoperative morbidity, mortality, morbidity and hospital stay (day) and intensive care unit (ICU) stay (day) within 30 days of surgery were evaluated. Complications included surgical, pulmonary, and cardiac complications. Disease-free survival and overall survival were evaluated as a long-term outcome. The final results were compared between groups.

Statistical analysis

The descriptive findings were presented with mean±standard deviation (SD) or median (min-max) for the continuous data, and with frequency (n) and percentage (%) for the categorical data. The normality assumptions were controlled by the Shapiro-Wilk test. Categorical data were analyzed by Pearson chi-square and Fisher’s Exact test. Mann-Whitney U test and independent t-test were used for the analysis of non-normally and normally distributed continuous variables, respectively. Kaplan–Meier methods were used to compare DFS and OS between the laparoscopic and open operation groups. Survival was then compared by the log-rank test. Statistical analysis was made using IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp., Armonk, NY). Two-sided P-value of less than 0.05 was considered statistically significant.

RESULTS

Of the 87 patients included in the study, 46 (52.9%) were operated on laparoscopically and 41 (47.1%) were operated with an open method. The mean age of the patients was 61.9 ± 13.8 (min–max: 23–88) years. Half of the patients were male and 50% were female. There was no significant difference between the groups in terms of ASA scores (P = 0.490), presence of comorbid disease (P = 0.910) and tumor location (P = 0.619). Although the rates of pathological stage 0–I (30.4%) in the laparoscopic group, and stage II (48.8%) and stage III (41.5%) in the open group were higher, this was not statistically significant (P = 0.056) (Tab. I).
There was no significant difference in terms of the extent of resection (P = 0.702), anastomosis technique (P = 0.807), transfusion requirement (P = 0.999), number of retrieved lymph nodes (P = 0.946) and positive lymph nodes (P = 0.972). Conversion to open surgery was performed due to intra-abdominal adhesions in 4 (8.6%) patients who underwent laparoscopic right hemicolectomy. The median operation time of the laparoscopic group was 150 minutes (min–max: 120–200), and of the open group – 125 minutes (min–max: 70–360); the operation time of the laparoscopic group was significantly higher (P < 0.001). While the median blood loss was calculated as 100 (mL) (min–max: 50–300) in the laparoscopic group and 200 (mL) (min–max: 50–350) in the open group, the amount of blood loss was significantly higher in those who underwent open surgery (P < 0.001) (Tab. II.).

The incidence of post-operative complications in the open group (26.8%) was higher than in the laparoscopic group (6.5%) (P = 0.010). The rate of anastomotic leakage (9.8%) was higher in patients who underwent open surgery compared to laparoscopic patients (0%) (P = 0.045). There was no significant difference between the 30-day reoperation rates (P = 0.471) and ICU stay (P = 0.318) between the laparoscopic and open groups. The hospitalization time (mean rank: 50.23) of those who underwent open surgery was longer than those who underwent laparoscopic surgery (mean rank: 37.37) (P = 0.009). It was observed that those who underwent open surgery started oral intake later (P < 0.001) (Tab. III.).

The follow-up time in the study ranged between 1 and 87 months. The 3-year and 5-year overall survival (OS) rates were 92%, and 90.3%, respectively. The 3-year and 5-year disease-free survival (DFS) rates were calculated as 90.6% and 80.1%, respectively. The mean OS and DFS time in the study population were 79.8 months (95% confidence interval [CI]: 75–84.5) and 73.7 months (95% CI: 67.3–80), respectively. No statistically significant differences were found between the laparoscopic and open operation in terms of overall OS rate (laparoscopic group: 80.3 months [95% CI: 74.1–86.4] versus open group: 77.2 months [95% CI: 69.2–85.2]; P = 0.400) and DFS rate (laparoscopic group: 73.4 months [95% CI: 64.8–82] versus open group: 72.6 months [95% CI: 62.9–82.2]; P = 0.781). These long-term outcomes are shown in Tab. IV. The Kaplan-Meier curves comparing the overall and disease-free survival rates in the two groups are presented in Fig. 1., 2.

**DISCUSSION**

Right-sided colon cancers constitute 40% of colorectal malignancies. Recently, laparoscopic surgery for colorectal cancers has become the standard procedure and is gaining wide popularity [6]. The ability to resect right-sided colon tumors by midline or paramedian mini-laparotomy incision may have caused laparoscopic right hemicolectomy to become more widespread later. There have been many studies showing that laparoscopic surgery is feasible and oncologically safe, especially in the treatment of left colon and rectal cancer [7, 8]. However, studies on laparoscopic surgery of right-sided colon cancer are relatively few in the literature [9].

In this study, no difference was found between the open and laparoscopic groups in terms of demographic data and patient characteristics. This result is consistent with previous studies [10].

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**Tab. III. Postoperative and Short-Term Outcomes.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Laparoscopic (n = 46)</th>
<th>Open (n = 41)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative complications</td>
<td>3 (6.5)</td>
<td>11 (26.8)</td>
<td>0.010</td>
</tr>
<tr>
<td>Surgical complications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anastomotic leakage</td>
<td>0 (0)</td>
<td>4 (9.8)</td>
<td>0.045</td>
</tr>
<tr>
<td>Haemorrhage</td>
<td>0 (0)</td>
<td>1 (2.4)</td>
<td>0.471</td>
</tr>
<tr>
<td>Wound infection</td>
<td>1 (2.2)</td>
<td>4 (9.8)</td>
<td>0.183</td>
</tr>
<tr>
<td>Intraabdominal abscess</td>
<td>0 (0)</td>
<td>2 (4.9)</td>
<td>0.219</td>
</tr>
<tr>
<td>Chylous ascites</td>
<td>0 (0)</td>
<td>1 (2.4)</td>
<td>0.471</td>
</tr>
</tbody>
</table>

**Tab. IV. Disease-free and overall survival of the groups.**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Laparoscopic (n = 46)</th>
<th>Open (n = 41)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease-free survival (%)</td>
<td></td>
<td></td>
<td>0.781</td>
</tr>
<tr>
<td>3-year</td>
<td>85.5</td>
<td>83.4</td>
<td></td>
</tr>
<tr>
<td>5-year</td>
<td>79.4</td>
<td>79.5</td>
<td></td>
</tr>
<tr>
<td>Mean DFS (months) (95%CI)</td>
<td>73.4 (64.8–82)</td>
<td>72.6 (62.9–82.2)</td>
<td>0.400</td>
</tr>
<tr>
<td>Overall survival (%)</td>
<td></td>
<td></td>
<td>0.400</td>
</tr>
<tr>
<td>3-year</td>
<td>95</td>
<td>88.5</td>
<td></td>
</tr>
<tr>
<td>5-year</td>
<td>95</td>
<td>84.9</td>
<td></td>
</tr>
<tr>
<td>Mean OS (months) (95%CI)</td>
<td>80.3 (74.1–86.4)</td>
<td>77.2 (69.2–85.2)</td>
<td></td>
</tr>
</tbody>
</table>

In our study, the overall postoperative complication rate was found to be significantly lower in the laparoscopic group (P = 0.010). Anastomotic leakage was found to be significantly higher in open surgery patients when the type of complication was examined (P = 0.045). No mortality was observed in any patient in this study. In the literature, there are some studies examining the short-term results of open and laparoscopic right hemicolectomy. The systematic review of 3049 patients by Arezzo et al. is invaluable in this regard. In their study, morbidity and mortality were lower in the laparoscopic group [11]. In consistence with our study, Rausa et al. reported that the overall complication rate was higher in patients who underwent open right hemicolectomy [12]. Koc et al. reported...
that the overall postoperative complication rate was lower in the laparoscopic group [10]. In contrast, Jurowich et al. did not find a significant difference in terms of postoperative complications, including anatomic complications [13].

One of the problems in patients undergoing upper abdominal surgery is pulmonary complications and their incidence varies between 17 and 88% [14]. The development of pulmonary complications in these patients is attributed to both the type of surgery and the size of the incision [15, 16]. Especially the large incision causes the postoperative pain to be excessive and the respiration to be adversely affected. Excess pulmonary complications, on the other hand, increase the dependence on mechanical ventilation, leading to a prolonged ICU stay and hospital stay.

In our study, pulmonary complications developed in only 1 patient in both groups (P = 0.999). Cha-Ze Lee et al. stated that laparoscopic right hemicolectomy reduces the risk of pulmonary complications [17].

In this study, conversion to open surgery was performed in 4 (8.6%) patients who underwent laparoscopic surgery. Conversion rates in the literature range between 0% and 6.6% [18–20]. The high conversion rate in our study may be related to the learning curve and is similar to the study of Kim et al. (13.8%) [18].

In this study, no difference was found between the groups in terms of pathological stage, number of retrieved total lymph nodes and number of metastatic lymph nodes. This is in line with the literature [10, 21].

In our study, the median operation time of the laparoscopic group was 150 minutes (min–max: 120–200), and of the open group 125 minutes (min–max: 70–360); the operation time of the laparoscopic group was significantly higher (P < 0.001).

The long duration of the surgeries in the laparoscopic group may be releted to the learning curve and the longer duration of the complete mesocolic excision in the laparoscopic group. In the literature, the operative time for laparoscopic right hemicolectomy is 175 to 279 minutes, and for open right hemicolectomy it varies between 159 and 179 min [19, 20, 22].

Although there was no significant difference between the groups in terms of 30-day reoperation rates (P = 0.471) and ICU stay (P = 0.318), it was observed that hospital stay was shorter (P = 0.009) and oral intake was started earlier (P < 0.001) in those who underwent laparoscopic surgery. This result can be releted to the longer duration of postoperative pain, later initiation of bowelmotions and later initiation of oral feeding in patients who underwent open surgery. It has also been shown in previous studies that laparoscopic surgery has advantages such as shorter hospital stay and early initiation of oral nutrition [12, 13].

When we analyzed the long-term oncological results, no significant difference was found between the groups in terms of 3-year and 5-year OS and DFS (respectively, P = 0.400; P = 0.781). This result is similar to other study results. In the meta-analysis of Negoi et al., no significant difference was found in terms of DFS and OS [23]. Similar results were found in another study [10].

The limitations of this study are that this is a single-center, non-randomized, retrospective design, operations are performed by different surgeons, and the sample size is small.

**CONCLUSION**

Laparoscopic and open right hemicolectomy operations have similar results in terms of pathological and long-term oncological findings. Laparoscopic method has some advantages such as shorter hospital stay, low postoperative morbidity, and early initiation of oral nutrition. In conclusion, the laparoscopic method is safe and feasible in right-sided colon cancers.

**ETHICAL APPROVAL**

This study was planned after the approval of the Ankara University Medical Faculty Ethical Committee.
REFERENCES