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# A Comparative Analysis of Short-term Clinical Outcomes Between Laparoscopic and Open Surgical Approaches in the Sigmoid Colon Cancer

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**Abstract**

**Background:** Sigmoid cancer is prevalent and responsible for over 10% of cancer-related deaths. The primary treatment is surgical resection of the colon and affected lymph nodes, done via open or laparoscopic surgery.

**Objective:** This study aimed to investigate short-term clinical outcomes between laparoscopic and open surgical approaches for sigmoid colon cancer.

**Methods:** This cross-sectional study involved 90 patients with sigmoid cancer, comprising 44 patients in the open surgery group and 46 in the laparoscopic group. Demographic information, surgery duration, length of hospital stay, duration of NPO after surgery, postoperative infections, anastomotic leaks, and pathological results of excised lymph nodes were collected. IBM SPSS version 20 was utilized for the analysis.

**Results:** Our study included 90 patients (37 women, 53 men) with an average age of 59.93±8.60 years. The open surgery group consisted of 44 patients, while the laparoscopic surgery group comprised 46 patients. The results indicated that laparoscopic surgery was more effective at resecting more lymph nodes, resulting in shorter hospital stays and shorter fasting (NPO) times than open surgery. (P-value<0.005).

**Conclusion:** Laparoscopic surgery is a safe, reliable, and secure option for patients with sigmoid cancer, as this technique not only minimizes the length of hospitalization but also results in improved outcomes and expedited patient recovery.

***Keywords:*** Colorectal Cancer, Sigmoid Cancer, Laparoscopic Surgery, Open Surgery.

## 1. Background

Colorectal cancers are the third most common cancers worldwide. Almost 1.2 million patients with colorectal cancer are diagnosed annually, and approximately 600,000 of these patients die from colorectal cancer. Generally, the treatment of colon cancer is surgical removal of the affected area along with the involved lymph node (1,2). Recent advancements in surgical techniques, particularly with the introduction of laparoscopic and robotic methods, have enabled surgeons to overcome many challenges faced during and after surgery (3). However, laparoscopic techniques are not universally regarded as a complete substitute for open surgery. This situation mirrored the surgical community's skepticism in 1985 when Dr Eric performed the first laparoscopic cholecystectomy. While there is no doubt about the effectiveness of laparoscopic methods for procedures such as colon

resection and lymph node removal in colorectal cancers, there are still many unanswered questions regarding the advantages of laparoscopic surgery compared to open surgery (4).

## 2. Objective

Given the rapid advancements in surgical techniques and the outdated nature of existing studies on this topic, it is crucial to conduct this study. The goal was to update and compare the outcomes and effectiveness of open versus laparoscopic surgery in treating sigmoid colon cancer.

## 3. Methods

### *3.1. Study Design and Participants*

This cross-sectional study was conducted among patients with sigmoid cancer who were referred to the General Surgery Department of Arya Hospital in Mashhad, Iran, in 2022 and 2023. The two groups of the population of our study included patients with sigmoid cancer undergoing elective open and laparoscopic colon resection. Inclusion criteria included localized sigmoid tumors and patients undergoing their first colectomy for sigmoid cancer. Exclusion criteria were metastatic sigmoid cancer, additional surgeries performed alongside resection, and conversion from laparoscopic surgery to open surgery.

### *3.2. Surgical Technique*

Perioperative care protocols were implemented for both groups according to the standard method. All operations were conducted by a single surgical team following a standardized protocol. The decision to use open or laparoscopic surgery was influenced by the different periods and a shift in surgical approach, driven by the team's familiarity with the minimally invasive technique.

### *3.3. Measures*

Data on age, sex, weight, comorbidities, routine tests, duration of surgery, days of NPO, length of hospital stay, postoperative complications (including wound infection and anastomotic leak) for 2 weeks, lymph nodes removed in the pathology specimen, and other information were documented.

### *3.4. Statistical Analysis*

During data analysis, data normality was first verified using the Shapiro-Wilk test. Once normality was established, parametric tests such as the Student's t-test were applied; for non-normal data, the Mann-Whitney U test was used. The Chi-Square test was used for nominal-scale data, whereas, when more than 20% of the expected frequencies in the tables were less than 5, Fisher's Exact Test was used. The software used in this study was SPSS version 26, and the significance level for all tests was set at $p < 0.05$.

### *3.5. Ethical Considerations*

This research was approved by the Ethics Committee of Islamic Azad University, Mashhad Medical Sciences Unit (IR.IAU.MSHD.REC.1401.123).

## 4. Results

In this study, 90 patients, including 53 men and 37 women with an average age of 59.93±8.60 years who were diagnosed with sigmoid cancer, were analyzed in two groups based on the surgical technique: open surgery (44 patients) and laparoscopic surgery (46 patients). The results indicated no significant differences between the two groups in gender (P-value = 0.970), age (P-value = 0.464), body mass index (P-value = 0.734), underlying diseases (P-value = 0.844), or tumor stage (P-value = 0.678).

The mean surgical duration was 109.20 minutes in the open surgery group and 106.41 minutes in the laparoscopic surgery group, with no significant difference

between the groups (P = 0.414). The analysis of hospital stay data revealed a substantial difference between the two groups (P < 0.001). Patients who underwent laparoscopy experienced shorter hospital stays, as shown in Table 1. Additionally, there was a significant difference in NPO duration between the two groups (P = 0.0001), indicating that patients undergoing laparoscopy had shorter NPO times. Further details on this parameter are available in Table 2.

**Table 1. The Distribution of Hospital Stay Duration.**

| Group | Minimum | Maximum | Median | Mean (SD) | P-value |
|---|---|---|---|---|---|
| Open surgery (n=44) | 4.00 | 7.00 | 5.00 | 5.20 (0.98) | t = 3.57 P-value = 0.001 |
| Laparoscopic surgery (n=46) | 3.00 | 9.00 | 4.00 | 4.38 (1.19) | |
| Total (n=90) | 3.00 | 9.00 | 5.00 | 4.79 (1.16) | |

**Table 2. The Distribution of NPO (day) duration.**

| Group | Minimum | Maximum | Median | Mean (SD) | P-value |
|---|---|---|---|---|---|
| Open surgery (n=44) | 2.00 | 6.00 | 3.00 | 3.39 (0.87) | t = 5.64 P-value = 0.0001 |
| Laparoscopic surgery (n=46) | 2.00 | 4.00 | 2.00 | 2.50 (0.59) | |
| Total (n=90) | 2.00 | 6.00 | 3.00 | 2.93 (0.86) | |

Regarding postoperative surgical site infections, no significant difference was found between the two groups: 7 (15.9%) in the open group and 2 (4.3%) in the laparoscopic group (P-value = 0.087). Furthermore, there was no significant difference in anastomotic leakage rates between the groups: 4 (9.1%) in the open group and 4 (8.7%) in the laparoscopic group (P = 0.999). However, there was a significant difference in the number of resected lymph nodes between the two groups (P-value = 0.015), indicating that the laparoscopy group had more resected lymph nodes. (Table 3).

**Table 3. Comparison of resected lymph nodes between open and Laparoscopic groups**

| Group | Minimum | Maximum | Median | Mean (SD) | P-value |
|---|---|---|---|---|---|
| Open surgery (n=44) | 2.00 | 18.00 | 6.00 | 6.89 (3.23) | t = -2.45 P-value = 0.015 |
| Laparoscopic surgery (n=46) | 4.00 | 14.00 | 8.00 | 8.39 (2.51) | |
| Total (n=90) | 2.00 | 18.00 | 8.00 | 7.66 (2.96) | |

## 5. Discussion

Our study included 90 patients (37 women, 53 men) with an average age of 59.93±8.60 years. The results indicated that laparoscopic surgery was more effective in resecting a greater number of lymph nodes, resulting in shorter hospital stays. They led to a shorter duration of fasting (NPO) than open surgery.

A randomized controlled trial conducted by Yamamoto S and colleagues in 2014 in Japan focused on colorectal cancer patients without organ involvement. The study found that patients undergoing laparoscopic surgery experienced reduced blood loss, although operative time was longer than with open surgery. Additionally, the time until the first passage of the flatus was shorter for those in the laparoscopic group. These patients also required fewer analgesics within 5 days post-surgery and had shorter hospital stays (5). The findings of this study on shorter hospital stays after laparoscopic surgery are consistent with our results.

In 2017, Zhang X and colleagues conducted a meta-analysis in Japan that examined intraoperative and postoperative outcomes in colorectal cancer patients undergoing laparoscopic surgery compared to conventional open surgery. The study found that laparoscopic surgery was

associated with longer operative times, less blood loss, shorter incision lengths, fewer hospital stays, quicker recovery of bowel function (as indicated by the time to first flatus), fewer wound infections, and fewer postoperative complications. There were no significant differences in several other factors, including the number of blood transfusions, the number of lymph nodes resected, the time to start a liquid or soft diet, the time to the first bowel movement, the rates of reoperation, ileus, anastomotic leakage, pulmonary infections, urinary complications, or mortality (6). Similar to our study, this report also found shorter hospital stays for patients undergoing laparoscopic surgery. However, unlike our findings, there were no differences in the number of lymph nodes resected or the duration of being NPO between the two procedures. This discrepancy may be due to the limitations of our sample size.

A 2008 study by Mirza and colleagues found no statistically significant differences between laparoscopic and open surgery groups in patient survival rates, intraoperative mortality, tumor resection margins, or the number of lymph nodes harvested. The cumulative recurrence rate for colon cancer favored open surgery, while no differences were observed between the two treatments for rectal cancer. Ultimately, the study reaffirms that laparoscopic surgery is a safe and effective alternative to conventional open surgery regarding long-term survival data in potentially curable colorectal cancer (7). This conclusion aligns with our findings.

Another systematic review and meta-analysis conducted in 2016 by Fujii S and colleagues revealed that the operative time for laparoscopic surgery was longer compared to open surgery in colorectal cancer. However, clinical parameters such as estimated blood loss, overall complication rates, surgical site infections, and the risks of bowel obstruction, ileus, and cardiovascular morbidity were lower in laparoscopic surgery than in open surgery. In the long-term analysis, there was no difference in overall survival rates, and the number of lymph nodes harvested was comparable between the two surgical approaches. The study concluded that for elderly patients with colorectal cancer, laparoscopic surgery offers short-term advantages over open surgery, except for operative time. Long-term outcomes and oncological clearance from laparoscopic surgery are similar to those of open surgery. These findings support the view that laparoscopic surgery is an effective option for elderly patients with colorectal cancer (8). Unlike our study, this research found a similar number of lymph nodes removed with both surgical techniques, which may be attributable to differences in sample size or surgical methods.

A study conducted by Niitsu H and colleagues in 2016 in Japan found that laparoscopic surgery had several advantages over open surgery. The duration of open surgery was shorter, and the estimated blood loss was lower during laparoscopic surgery. Notably, no significant difference was observed between the two procedures in overall survival. The study concluded that laparoscopic surgery is safe and not inferior to open surgery for elderly patients with colorectal cancer and poor functional status (9). Similar to our findings, laparoscopic surgery was preferred over open surgery in this study.

In 2009, Neudecker and colleagues in Germany conducted a randomized trial comparing short-term outcomes between laparoscopic and open surgery for colorectal cancer. The study found no significant differences in surgical complications between the two procedures, nor was there a variation in mortality rates. However, the hospital stays following laparoscopic surgery were shorter, and this difference was deemed significant.

Therefore, while laparoscopic surgery for colorectal cancer is associated with longer operating times, it does not lead to a reduction in complications, even for patients in a moderately high-risk category (10). Our findings on hospital stay duration align with this study's results.

Limitations of this study include a small patient sample, a single-center focus, and short-term follow-up. A multicenter study with a larger sample size and longer follow-up duration is recommended.

## 6. Conclusion

This investigation presents a thorough evaluation of the capacity to resect a greater number of lymph nodes in laparoscopic surgery compared to open surgery in cases of sigmoid cancer. The findings indicate that laparoscopic surgery is associated with shorter hospital stays and shorter postoperative NPO duration. Overall, these results suggest that laparoscopic surgery is a safe, reliable, and secure option for patients with sigmoid cancer, as this technique not only minimizes the length of hospitalization but also results in improved outcomes and expedited patient recovery.

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**Availability of data and materials**: The data that support the findings of this study are available from the corresponding author upon reasonable request.

**Conflicts of interests:** All authors declared that they have no competing interests.

**Consent for publication:** Not applicable.

**Ethics approval and consent to participate:** The present study has an ethics code with an ID number (IR.IAU.MSHD.REC.1401.123). This study was conducted following the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants included in the study.

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**Author contributions:** Conceptualization: MJGH- Methodology and Formal analysis: SNN - Investigation, Data curation: MJGH and SNN - Writing- Original draft: HGH and TZ - Writing - review & editing: MJGH, HGH, and TZ.

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