

# Clinical Efficacy of Laparoscopic Radical Colorectal Cancer Treatment for Colorectal Cancer and Its Effect on Immune Function

Danguang Liu\*

Zhenjiang Hospital of Traditional Chinese Medicine, Zhenjiang, Jiangsu 212001, China

\*Corresponding author: Danguang Liu, 13775363220@139.com

**Copyright:** © 2024 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

**Abstract:** *Objective:* To explore the therapeutic effect of laparoscopic radical colorectal cancer treatment in colorectal cancer patients. *Methods:* A total of 50 colorectal cancer patients treated between August 2018 and August 2023 were randomly divided into two groups: Group A underwent laparoscopic radical colorectal cancer surgery, while Group B received open surgery. Clinical indicators, inflammatory factors, immune function indicators, and complications were compared between the two groups. *Results:* Group A showed significantly shorter operation times, faster recovery times, and reduced hospital stays compared to Group B. Additionally, Group A had less abdominal drainage and intraoperative bleeding ( $P < 0.05$ ). Levels of interleukin (IL)-4, IL-6, ultrasensitive C-reactive protein (hs-CRP), and tumor necrosis factor-alpha (TNF- $\alpha$ ) were lower in Group A compared to Group B ( $P < 0.05$ ). Furthermore, immune function indicators, including CD3<sup>+</sup>, CD4<sup>+</sup>, CD8<sup>+</sup>, and CD4<sup>+</sup>/CD8<sup>+</sup> ratios, were better in Group A ( $P < 0.05$ ). The complication rate in Group A was also lower than in Group B ( $P < 0.05$ ). *Conclusion:* Laparoscopic radical treatment for colorectal cancer is efficient and feasible, causing minimal immune function impairment and inflammatory response. It also shortens postoperative recovery time.

**Keywords:** Colorectal cancer; Laparoscopic radical colorectal cancer surgery; Immune function; Efficacy

**Online publication:** August 9, 2024

## 1. Introduction

Colorectal cancer is a common monocarcinoma type and accounts for a high proportion of malignant gastrointestinal diseases, the causative agent of which is unclear and may be related to diet and gastrointestinal pathology <sup>[1]</sup>. In the context of changing dietary and lifestyle habits, the risk of colorectal cancer is elevated and progresses at a younger age <sup>[2]</sup>. Currently, colorectal cancer is mostly treated with surgical protocols in clinical practice. Conventional open surgery can completely remove the lesions in the colorectal region, but it is traumatic and can increase the degree of damage to the abdominal tissues, which is not conducive to the recovery of colorectal cancer patients <sup>[3]</sup>. Laparoscopic surgery is a commonly used minimally invasive type of surgery, which can shorten the operation time and reduce the surgical incision, which is conducive to patient

recovery<sup>[4]</sup>. This paper discusses the effect of laparoscopic colorectal cancer radical surgery on 50 cases of colorectal cancer patients admitted from August 2018 to August 2023.

## 2. Materials and methods

### 2.1. General information

Fifty cases of colorectal cancer patients admitted to the hospital during August 2018–2023 were grouped using a random number table. The colorectal cancer patients' data were compared between the two groups and were found to be comparable ( $P > 0.05$ ; **Table 1**).

**Table 1.** Analysis of colorectal cancer patients' data

Groups	Sex (n)		Age (years)		Duration of illness (months)		Body mass index (kg/m <sup>2</sup> )	
	Male	Female	Interval	Mean	Interval	Mean	Interval	Mean
Group A (n = 25)	14 (56.00)	11 (44.00)	40–76	61.84 ± 1.88	7–12	10.15 ± 1.42	19–24	22.84 ± 1.42
Group B (n = 25)	15 (60.00)	10 (40.00)	40–77	61.82 ± 1.92	7–13	10.13 ± 1.41	19–25	22.91 ± 1.36
$\chi^2 / t$	0.0821		0.0372		0.0500		0.1780	
<i>P</i>	0.7745		0.9705		0.9604		0.8595	

### 2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) pathologically confirmed diagnosis of colorectal cancer, expected to survive for more than 1 year; (2) informed consent; (3) imaging suggests that the disease is located in the sigmoid colon, rectum, proximal colon, and other regions.

Exclusion criteria: (1) hematological system pathology; (2) history of colorectal surgery; (3) complete intestinal obstruction; (4) intussusception.

### 2.3. Methods

- (1) Group A – Laparoscopic radical surgery for colorectal cancer: Patients received general anesthesia and were positioned in the lithotomy position. A CO<sub>2</sub> pneumoperitoneum was created with an abdominal pressure of 10–15 mmHg. The main operation port, measuring 12 mm in diameter, was placed 5 cm to the left of the umbilicus, while secondary ports, each 5 mm in diameter, were positioned in the right and left epigastric midclavicular regions and the right lower abdominal region. A laparoscope was inserted through the main port to observe the abdominal organs and assess for metastasis. The procedure included local blood vessel separation and ligation, mesenteric vessel processing, lymph node dissection, and mobilization of the hepatic flexure of the colon. The lesion, along with a 5 cm margin of the affected intestinal segment, was resected. The intestinal ends were then anastomosed, the abdominal cavity was irrigated with saline and drained, and the incisions were closed.
- (2) Group B – Open laparotomy: Patients also received general anesthesia and were positioned in the lithotomy position. A catheter was placed, and a 20 cm incision was made at the superior edge of the umbilicus. The abdominal wall was opened layer by layer, and the mesentery and retroperitoneal tissues were dissected. The mesenteric arteries and veins were ligated, lymph nodes were cleared, and the cancerous tissue was excised. Corresponding blood vessels were tied off, the abdominal cavity was rinsed, and a drainage tube was left in place.

## 2.4. Observation indexes

- (1) Clinical indicators: Recorded data included surgical operation time, time to first flatus, duration of hospital stay, volume of abdominal drainage, and intraoperative blood loss.
- (2) Inflammatory factors: A 3 mL sample of fasting venous blood was collected, and the supernatant was centrifuged. Interleukin-4 (IL-4), IL-6, and tumor necrosis factor-alpha (TNF- $\alpha$ ) levels were measured using enzyme-linked immunosorbent assay (ELISA), and C-reactive protein (CRP) was monitored using an automated biochemical analyzer.
- (3) Immune function: Flow cytometry was used to detect CD3<sup>+</sup>, CD4<sup>+</sup>, and CD8<sup>+</sup> cells, and to calculate the CD4<sup>+</sup>/CD8<sup>+</sup> ratio.
- (4) Complications: Recorded complications included urinary tract infections, incision infections, intestinal obstruction, and others.

## 2.5. Statistical analysis

Data were processed using SPSS 21.0 software. Categorical data were described using percentages and analyzed with the chi-squared ( $\chi^2$ ) test, while continuous data were presented as mean  $\pm$  standard deviation (SD) and analyzed with the *t*-test. A *P*-value  $< 0.05$  was considered statistically significant.

## 3. Results

### 3.1. Clinical indicators

**Table 2** shows that the surgical operation time, exhaustion time, and hospitalization time of Group A were shorter than that of Group B. Abdominal drainage and intraoperative bleeding were also lesser in Group A ( $P < 0.05$ ).

**Table 2.** Comparison of clinical indicators (mean  $\pm$  SD)

Groups	Operation time (min)	Exhaustion time (d)	Hospitalization time (d)	Abdominal drainage (mL)	Intraoperative bleeding (mL)
Group A ( <i>n</i> = 25)	151.25 $\pm$ 6.84	3.61 $\pm$ 0.48	8.51 $\pm$ 1.25	101.84 $\pm$ 7.25	142.84 $\pm$ 8.43
Group B ( <i>n</i> = 25)	184.25 $\pm$ 8.44	5.48 $\pm$ 0.69	15.44 $\pm$ 2.43	126.36 $\pm$ 8.49	215.36 $\pm$ 9.68
<i>t</i>	15.1882	11.1239	12.6800	10.9814	28.2483
<i>P</i>	0.0000	0.0000	0.0000	0.0000	0.0000

### 3.2. Inflammatory factor indicators

After surgery, IL-4, IL-6, hs-CRP, and TNF- $\alpha$  were significantly lower in Group A than in Group B ( $P < 0.05$ ), as shown in **Table 3**.

**Table 3.** Comparison of inflammatory factor indicators before and after operation (mean  $\pm$  SD)

Groups	IL-4 (pg/mL)		IL-6 (pg/mL)		hs-CRP (mg/L)		TNF- $\alpha$ (pg/mL)	
	Before	After	Before	After	Before	After	Before	After
Group A ( <i>n</i> = 25)	87.11 $\pm$ 2.87	62.11 $\pm$ 1.43	32.72 $\pm$ 2.42	12.65 $\pm$ 1.25	3.68 $\pm$ 1.21	2.21 $\pm$ 0.84	82.38 $\pm$ 2.48	50.61 $\pm$ 1.74
Group B ( <i>n</i> = 25)	87.16 $\pm$ 2.89	75.36 $\pm$ 1.89	32.69 $\pm$ 2.41	24.21 $\pm$ 1.68	3.69 $\pm$ 1.18	4.39 $\pm$ 0.96	82.39 $\pm$ 2.51	65.75 $\pm$ 1.96
<i>t</i>	0.0614	27.9533	0.0439	27.6025	0.0296	8.5449	0.0142	28.8830
<i>P</i>	0.9513	0.0000	0.9652	0.0000	0.9765	0.0000	0.9888	0.0000

### 3.3. Immune function indexes

After operation, CD3<sup>+</sup>, CD4<sup>+</sup>, CD8<sup>+</sup>, and CD4<sup>+</sup>/CD8<sup>+</sup> indexes of Group A were better than that of Group B ( $P < 0.05$ ; Table 4).

**Table 4.** Comparison of immune function indexes before and after operation (mean  $\pm$  SD)

Groups	CD3+ (%)		CD4+ (%)		CD8+ (%)		CD4 <sup>+</sup> /CD8 <sup>+</sup>	
	Before	After	Before	After	Before	After	Before	After
Group A (n = 25)	32.84 $\pm$ 2.14	60.75 $\pm$ 2.84	30.58 $\pm$ 2.74	45.42 $\pm$ 3.18	33.52 $\pm$ 3.84	21.68 $\pm$ 2.42	0.82 $\pm$ 0.12	2.31 $\pm$ 0.32
Group B (n = 25)	32.89 $\pm$ 2.12	46.11 $\pm$ 2.76	30.61 $\pm$ 2.75	38.06 $\pm$ 3.07	33.54 $\pm$ 3.82	28.44 $\pm$ 2.68	0.84 $\pm$ 0.14	1.06 $\pm$ 0.25
<i>t</i>	0.0830	18.4839	0.0386	8.3256	0.0185	9.3605	0.5423	15.3911
<i>P</i>	0.9342	0.0000	0.9693	0.0000	0.9853	0.0000	0.5901	0.0000

### 3.4. Complication indicators

Table 5 shows that the rate of postoperative complications in Group A was lower than in Group B ( $P < 0.05$ ).

**Table 5.** Analysis of postoperative complication indicators of colorectal cancer [*n* (%)]

Groups	Urinary tract infections	Incisional infections	Bowel obstruction	Incidence rate
Group A (n = 25)	1 (4.00)	0 (0.00)	0 (0.00)	1 (4.00)
Group B (n = 25)	3 (12.00)	2 (8.00)	1 (4.00)	6 (24.00)
$\chi^2$	-	-	-	4.1528
<i>P</i>	-	-	-	0.0416

## 4. Discussion

Colorectal cancer has a complex pathogenesis related to diet, environment, digestive system lesions, heredity, and other factors. It often presents no specific signs at the initial stage, leading some patients to delay treatment until the disease is advanced. Therefore, it is crucial to diagnose and treat colorectal cancer as early as possible [5,6]. Laparotomy for colorectal cancer can completely remove the tumor and lymph nodes, with a low risk of tumor recurrence after surgery. However, laparotomy involves a large incision, which can trigger physiological and psychological stress reactions, increase patients' pain, and prolong postoperative recovery time [7,8]. Additionally, some frail colorectal cancer patients are bedridden for a long time after surgery, increasing the risk of deep vein thrombosis and lung infection, which is unfavorable for prognosis [9,10].

In recent years, laparoscopic radical surgery for colorectal cancer has been increasingly used in clinical treatment. This minimally invasive surgery involves inserting laparoscopic instruments into the abdominal cavity to complete the necessary procedures, achieving similar efficacy to open surgery. Compared to open surgery, the advantages of laparoscopic surgery include the following [11,12]:

- (1) Reduced trauma: In laparoscopic surgery, 3–4 small incisions are made to perform the operation, reducing abdominal trauma and postoperative pain and promoting quicker recovery.
- (2) Wide applicability: This procedure can be used to treat colorectal cancer patients who are obese, elderly, or have other underlying conditions. It can be safely performed by skilled surgeons.
- (3) Lower complication rate: Large open abdominal incisions increase the amount of bleeding and expose

the abdominal cavity to air for extended periods, raising the risk of infection. Laparoscopic surgery minimizes these risks.

- (4) High accuracy: The laparoscope provides an expanded view of the surgical field, helping surgeons accurately locate lymph nodes and improve surgical precision.
- (5) Improved aesthetics: Open laparotomies often leave noticeable scars, while laparoscopic surgery results in small incisions and minimal scarring, preserving the abdomen's appearance.

Furthermore, laparoscopic radical surgery has become well-developed and is recognized for its efficacy by many colorectal cancer patients. However, it is essential to note that laparoscopic surgery requires high technical skill from the surgeon. Additionally, the procedure may affect gastrointestinal function, so patients should be advised to eat correctly and avoid stimulating and greasy foods postoperatively to shorten recovery time<sup>[13,14]</sup>.

Based on the data analysis in this paper, the surgical outcomes for colorectal cancer patients in Group A were better than those in Group B, with  $P < 0.05$ . This can be attributed to laparoscopy's ability to expand the surgical field and enhance surgical precision, allowing for complete lesion resection and prolonged patient survival. The smaller incisions in laparoscopic surgery also reduce damage to adjacent tissues, decrease intraoperative bleeding, and facilitate easier operation for the physician, which can shorten hospital stays for colorectal cancer patients<sup>[15,16]</sup>.

Another set of data showed that levels of IL-4, IL-6, hs-CRP, and TNF- $\alpha$  in Group A were lower than in Group B, with  $P < 0.05$ . This finding suggests that complete resection of cancerous tissue using laparoscopy can minimize mechanical stimuli and stress reactions, reduce immunosuppression, and enhance immune function<sup>[17,18]</sup>. Laparoscopic surgery does not expose the abdominal cavity, reducing the impact of external stimuli on abdominal tissues, leading to a milder inflammatory response and better maintenance of body function stability.

Additional data showed that the immune markers CD3<sup>+</sup>, CD4<sup>+</sup>, CD8<sup>+</sup>, and CD4<sup>+</sup>/CD8<sup>+</sup> were better in Group A compared to Group B, with  $P < 0.05$ . The precision of laparoscopic surgery, which expands the surgeon's operating field and reduces surgical trauma, supports gastrointestinal recovery, and has a smaller impact on immune function, resulting in better immune indices than open surgery<sup>[19,20]</sup>.

The final set of data indicated that the postoperative complication rate was lower in Group A than in Group B, with  $P < 0.05$ . This is because laparoscopic surgery reduces the exposure of the abdominal cavity and avoids large-scale mechanical operations, preventing infections, gastrointestinal injuries, and other adverse events, thus ensuring high overall safety.

In conclusion, laparoscopic radical colorectal surgery for colorectal cancer patients enhances the body's immune function, reduces inflammatory responses, and is safe and efficient, making it a valuable treatment option.

## Disclosure statement

The author declares no conflict of interest.

## References

- [1] Hu B, Chu C, Hu S, et al., 2022, Efficacy and Safety Analysis of Single-Port Plus One-Port Laparoscopic Radical Resection for Colorectal Cancer. *Journal of Laparoscopic Surgery*, 27(2): 124–129.
- [2] Mao Z, Du B, Sun H, et al., 2023, Analysis of Near-Term Efficacy and Long-Term Survival Outcomes of Laparoscopic Versus Open Surgery for Colorectal Cancer Patients Over 80 Years of Age. *Cancer Prevention and Control Research*, 50(11): 1121–1126.
- [3] Wang Y, Peng M, Xie W, et al., 2021, Analysis of Recent Efficacy of Two-Hole Laparoscopic Radical Resection for

Colorectal Cancer. *Chinese Journal of Gastrointestinal Surgery*, 24(1): 48–53.

- [4] Shu T, Wen H, Zhou H, et al., 2020, Study on the Effect and Safety of Laparoscopic Radical Colorectal Cancer Treatment for Elderly Colorectal Cancer. *Chongqing Medicine*, 49(2): 75–77.
- [5] Wei S, Guan S, Yang X, et al., 2022, Publication of Colorectal Cancer: Effect of Laparoscopic Radical Colorectal Cancer Treatment for Elderly Patients with Colorectal Cancer and the Effect on Gastrointestinal Function. *Journal of Interventional Radiology*, 31(5): 1.
- [6] Lu X, Zhao W, Huang P, 2023, Effect of Laparoscopic Radical Surgery for Colorectal Cancer in the Treatment of Obese Colorectal Cancer Patients and Its Effect on Gastrointestinal Hormones and Circulatory Function. *Laboratory Medicine and Clinics*, 20(19): 2872–2875.
- [7] Lou A, Niu G, Xu C, 2023, Effects of Laparoscopic Radical Rectal Cancer Surgery with Specimens Taken Through the Natural Cavity on Patients' Postoperative Recovery, Gastrointestinal Hormones, Body Fluids and Cellular Immunity. *Journal of Practical Cancer*, 38(8): 1308–1312.
- [8] Tang Y, 2023, Effect of Laparoscopic Radical Surgery on Gastrointestinal Function in Elderly Colorectal Cancer Patients. *Chinese and Foreign Medical Treatment*, 42(8): 49–53.
- [9] Shen L, Zhou S, Shi L, et al., 2023, Effects of Laparoscopic Radical Surgery on Stress Response, Immune Function Indexes and Complications in Patients with Rectal Cancer. *Zhejiang Trauma Surgery*, 28(1): 103–105.
- [10] Liu Y, Meng X, Zhang X, et al., 2020, Effect of Laparoscopic Radical Surgery on Stress Reaction and Gastrointestinal Hormone-Related Indexes in Patients with Rectal Cancer. *Journal of Clinical Military Medicine*, 2020(12): 1477–1478.
- [11] Lu J, Zhao S, Xie S, 2023, Clinical Study on Preservation of Left Colonic Artery in Laparoscopic Radical Rectal Cancer Surgery. *Chinese and Foreign Medicine*, 42(23): 60–63.
- [12] Jin J, Li X, Li S, et al., 2020, Clinical Study on the Preservation of Left Colonic Artery in Laparoscopic Radical Rectal Cancer Surgery. *Journal of Laparoscopic Surgery*, 25(5): 363–367.
- [13] Fu Y, Xu Q, 2020, Observation on the Effect of Laparoscopic and Open Radical Colorectal Cancer Surgery for Early Colorectal Cancer. *China Modern General Surgery Progress*, 23(7): 552–553.
- [14] Gao W, Tong Y, Meng Q, 2023, Effect of Laparoscopic Radical Surgery for Colorectal Cancer on Gastrointestinal Function and Trauma Recovery in Elderly Colorectal Cancer Patients. *Contemporary Medicine*, 29(3): 105–107.
- [15] Fan P, Xu H, Wang K, et al., 2021, Clinical Effect of Laparoscopic Radical Colorectal Cancer Surgery for Colorectal Cancer and Its Effect on Gastrointestinal Function. *Chinese Medical Science*, 11(12): 170–173.
- [16] Yu M, Zhang Y, Zhang W, 2021, Efficacy of Laparoscopic Radical Surgery for Colorectal Cancer in Treating Elderly Patients with Colorectal Cancer and Its Effect on Gastrointestinal Function. *Guizhou Medicine*, 45(11): 1747–1748.
- [17] Sun L, 2023, Effect of Laparoscopic Radical Surgery for Colorectal Cancer and Its Impact on Gastrointestinal Function of Patients. *Contemporary Medicine*, 29(12): 161–163.
- [18] Zhang H, Rong W, Wang Y, 2023, Effect of Pneumoperitoneum-Free Single-Port Laparoscopic Radical Colorectal Cancer Surgery on Stress Response and Complications in Colorectal Cancer Patients. *Cancer Progress*, 21(8): 874–876.
- [19] Zhang W, 2023, Analysis of the Effect of Laparoscopic Radical Surgery for Colorectal Cancer in the Treatment of Elderly Patients with Colorectal Cancer and Its Impact on Gastrointestinal Function. *China Practical Medicine*, 18(6): 10–14.
- [20] Jiang X, 2023, Clinical Efficacy Analysis of Laparoscopic Radical Surgery for Colorectal Cancer and Acute Intestinal Obstruction in Elderly Patients with Colorectal Cancer. *Chinese and Foreign Medical Treatment*, 42(8): 67–71.

**Publisher's note**

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.