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ABOUT COVER

Editorial Board Member of *World Journal of Clinical Cases*, Kai Zhang, PhD, Professor, Department of Psychiatry, Chaohu Hospital of Anhui Medical University, Hefei 238000, Anhui Province, China. zhangkai@ahmu.edu.cn

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Retrospective Study

Comparison of clinical efficacy and postoperative inflammatory response between laparoscopic and open radical resection of colorectal cancer

Long-Hai He, Bo Yang, Xiao-Qin Su, Yue Zhou, Zhen Zhang

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Long-Hai He, Bo Yang, Zhen Zhang, Department of General Surgery, The First People's Hospital of Wanzhou District, Chongqing 404040, China

Xiao-Qin Su, Yue Zhou, Department of Clinical Nutrition, The First People's Hospital of Wanzhou District, Chongqing 404040, China

Corresponding author: Long-Hai He, BM BCh, Associate Chief Physician, Department of General Surgery, The First People's Hospital of Wanzhou District, No. 388 East Tiancheng Road, Wanzhou District, Chongqing 404040, China. helh2021@163.com

Abstract

BACKGROUND

In recent years, the incidence of colorectal cancer (CRC) has increased annually, which has seriously threatened the health and quality of life of patients. In the treatment of CRC, both laparoscopic and radical resection are widely used.

AIM

To explore and discuss clinical efficacy and postoperative inflammatory response of laparoscopic and open radical resection of CRC.

METHODS

A total of 96 patients with CRC diagnosed in our hospital from March 2016 to April 2021 were selected, and were divided into the study group ($n = 48$) and control group ($n = 48$) using a simple random method. The control group was treated with open radical resection of CRC, and the study group was treated with laparoscopic radical resection of CRC. The perioperative conditions (operation time, intraoperative blood loss, the recovery time of gastrointestinal function, number of lymph node dissections and length of hospital stay), inflammatory response index levels [interleukin (IL)-6, IL-8, IL-10, C-reactive protein (CRP)] before and after operation, pain stress response indices [levels of neuropeptide (NPY), prostaglandin E2 (PGE2), 5-hydroxytryptamine (5-HT)], and the incidence of the complications between the two groups were counted.

RESULTS

The operation time in the study group was (186.18 ± 33.54 min), which was longer than that of the control group (129.38 ± 26.83 min), but the intraoperative blood

loss (111.34 ± 21.45 mL), recovery time of gastrointestinal function (25.35 ± 4.55 h), and hospital stay (10.09 ± 2.38 d) were better than those in the control group (163.77 ± 32.41 mL, 36.06 ± 7.13 h, 13.51 ± 3.66 d) ($P < 0.05$). There was no significant difference in the number of lymph node dissections between the study group (15.19 ± 3.04) and the control group (16.20 ± 2.98) ($P > 0.05$). There was no significant difference between the levels of serum IL-6 (9.79 ± 4.11 ng/mL), IL-8 (3.79 ± 1.71 ng/L), IL-10 (48.96 ± 12.51 ng/L) and CRP (7.98 ± 2.33 mg/L) in the study group and the control group (10.56 ± 3.78 ng/mL, 4.08 ± 1.45 ng/L, 50.13 ± 11.67 ng/L, 8.29 ± 2.60 mg/L) before the operation ($P > 0.05$). After the operation, there was no significant difference between the levels of serum IL-6 (19.11 ± 6.68 ng/mL). There was no significant difference in serum NPY (109.79 ± 13.46 UG/L), PGE2 (269.54 ± 37.34 ng/L), 5-HT (151.70 ± 18.86 ng/L) between the study group and the control group (113.29 ± 15.01 UG/L, 273.91 ± 40.04 ng/L, 148.85 ± 20.45 ng/L) before the operation ($P > 0.05$). The incidence of the complications in the study group (4.17%) was lower than that of the control group (18.75%) ($P < 0.05$).

CONCLUSION

Laparoscopic radical resection of CRC can reduce surgical trauma, inflammatory response and pain stress caused by surgery, which shortens rehabilitation of patients, with a low incidence of complications.

Key Words: Laparoscope; Open surgery; Colorectal cancer; Inflammatory response; Pain stress response

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Core tip: Through a set of retrospective studies, it was confirmed that laparoscopic radical resection of colorectal cancer can reduce surgical trauma, inflammation and pain stress caused by surgical treatment, and help shorten the recovery process of patients, with low complication rate, and safety is good.

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INTRODUCTION

As a type of multiple malignant tumor of the digestive system, colorectal cancer (CRC) is closely related to the living environment and dietary and living habits of patients[1]. Meanwhile, the location of CRC is more hidden than that of other tumors; therefore, there is a lack of specific clinical manifestations in the early stage. The disease usually has progressed to the middle and late stage when there are changes in defecation habits, abdominal pain, hematochezia, and other manifestations, thus leading to a poor prognosis[2]. Hence, it is of importance to perform a safe and effective treatment for patients with CRC in the early stage.

The traditional open surgery for patients with CRC can effectively remove the lesions, but there are some shortcomings, such as large trauma and slow postoperative functional recovery, which lead to obvious limitations in its clinical application[3]. In recent years, with the development of Cavescope technology, laparoscopic-assisted radical resection of CRC has become popular, which can reduce surgical trauma, ensure early recovery of body function postoperatively, reduce related complications, demonstrating the effectiveness and safety of the treatment[4,5].

However, laparoscopic surgery is complex, and the anatomical structure of CRC can increase the difficulty of the operation; thus, its specific application is still controversial[6]. In this study, 96 patients with CRC were selected and divided into the study group and control group to explore and discuss clinical efficacy and postoperative inflammatory response of laparoscopic and open radical resection of CRC.

MATERIALS AND METHODS

Baseline data

This study was approved by the Ethics Committee of our hospital. We selected 99 patients with CRC treated in the inpatient department of our hospital from March 2016 to April 2021. Inclusion criteria were as follows: (1) patients diagnosed through pathological examination; (2) age > 18 years; (3) patients with good compliance and communication skills, and who could cooperate to complete the investigation and research; (4) Dukes' stage A–C; and (5) patients and their families were aware of the study and signed the consent form. Exclusion criteria were as follows: (1) patients with other malignancies; (2) patients with a history of gastrointestinal surgery and intestinal obstruction; (3) patients with serious water and sodium retention and infection; (4) patients with kidney, liver and other organ dysfunction; (5) patients with coagulation dysfunction; and (6) patients who took drugs that affected gastrointestinal motility within 1 mo before inclusion in the study.

According to the case selection criteria, 96 cases meeting the requirements were finally included. They were divided into study group ($n = 48$) and control group ($n = 48$) according to the simple random number table method. There were 26 men and 22 women in the study group, age range 39–69 years, with an average of 53.91 ± 12.89 years; Dukes' stage: 21 stage A, 19 stage B and eight C; location of lesions: descending colon in three cases, ascending colon in six, sigmoid colon in nine and rectum in 30. There were 29 men and 19 women in the control group, average age 55.08 ± 14.11 years; Dukes' stage: 24 stage A, 17 stage B and seven stage C; location of lesions: descending colon in two cases, ascending colon in nine, sigmoid colon in 10 and rectum in 27. The clinical data of gender, age, Dukes' stage and lesion location were balanced and comparable between the two groups ($P > 0.05$).

Control group

Open radical resection of CRC was adopted. Patients underwent general anesthesia. The appropriate body position was selected according to the tumor location, where the size and location of the incision was determined in combination with the volume and location of the lesion. Routine abdominal examination was performed to clarify the relationship between the tumor location and adjacent organs and tissues. The proximal intestinal canal was ligated with warp cloth, the blood vessels were separated, peripheral lymph nodes were cleaned, root blood vessels were ligated *via* intestinal cutting, tumor was resected, and intestinal anastomosis was performed. The bleeding and circulation were checked, the abdominal cavity was cleaned, and the drainage tube was placed into the abdominal cavity and then closed. Postoperative routine fasting, analgesics, rehydration, and prophylactic antibiotics were given.

Study group

Laparoscopic radical resection of CRC was adopted. Patients underwent general anesthesia. Carbon dioxide artificial pneumoperitoneum was established, the abdominal cavity was explored to determine the position and lifting of the sigmoid colon, mesenteric blood vessels were separated, clamped and disconnected with a titanium clip. The inferior mesenteric blood vessels and surrounding connective tissue were separated with an ultrasonic knife. In case of vascular obstruction during separation, a titanium clip was used to clamp and clean the lymphatic tissue, and the ureters on both sides were strictly protected during separation. The peritoneum outside the colon was completely separated using an ultrasonic knife, the hepatic/splenic flexure of the colon was separated to ensure complete relaxation of the anastomosis, and an incision of ~5 cm was made on the abdominal wall to facilitate removal of the resected lesions. The intestinal stump was pulled out of the abdominal wall, anastomosed *in vitro*, and then returned to the abdominal cavity. The abdominal cavity was thoroughly rinsed with sterile normal saline, the drainage tube was routinely placed, and the incision was closed.

Observation indices

We measured operating time, intraoperative blood loss, recovery time of gastrointestinal function, number of lymph nodes dissected and length of hospital stay. Inflammatory response index levels [interleukin (IL)-6, IL-8, IL-10, C-reactive protein (CRP)] before and after the operation were measured. Pain stress response indices [levels of neuropeptide (NPY), prostaglandin E2 (PGE2), 5-hydroxytryptamine (5-HT)] before and after the operation were measured. The incidence of the complications between the two groups was measured.

Statistical analysis

SPSS version 22.0 was used for data analysis. The measurement data were expressed as mean \pm SD and analyzed by *t* test, and the numerical data were expressed as *n* (%) and analyzed by χ^2 test. $P < 0.05$ referred to a statistically significant difference.

RESULTS

Comparison of perioperative conditions between the two groups

The operating time in the study group was longer (186.18 ± 33.54 min) than that in the control group (129.38 ± 26.83 min), but the intraoperative blood loss (111.34 ± 21.45 mL), recovery time of gastrointestinal function (25.35 ± 4.55 h), and hospital stay (10.09 ± 2.38 d) were better than those in the control group (163.77 ± 32.41 mL, 36.06 ± 7.13 h, 13.51 ± 3.66 d) ($P < 0.05$). There was no significant difference in the number of lymph node dissections between the study group (15.19 ± 3.04) and control group (16.20 ± 2.98) ($P > 0.05$) as shown in [Table 1](#).

Comparison of inflammatory response index levels before and after the operation between the two groups

There was no significant difference between the levels of serum IL-6 (9.79 ± 4.11 ng/mL), IL-8 (3.79 ± 1.71 ng/L), IL-10 (48.96 ± 12.51 ng/L) and CRP (7.98 ± 2.33 mg/L) in the study group and control group (10.56 ± 3.78 ng/mL, 4.08 ± 1.45 ng/L, 50.13 ± 11.67 ng/L, 8.29 ± 2.60 mg/L) before the operation ($P > 0.05$). After the operation, there was no significant difference between the levels of serum IL-6 (19.11 ± 6.68 ng/mL) and the levels of IL-8 (12.61 ± 3.69 ng/L) and CRP (14.91 ± 5.56 mg/L) were lower than those in the control group (34.03 ± 9.40 ng/mL, 16.67 ± 4.54 ng/L, 21.79 ± 7.33 mg/L), and the level of IL-10 (36.48 ± 9.39 g/L) was higher than that in the control group (28.39 ± 7.61 g/L) ($P < 0.05$, [Table 2](#)).

Comparison of pain stress response indexes before and after the operation between the two groups

There was no significant difference in serum NPY (109.79 ± 13.46 UG/L), PGE2 (269.54 ± 37.34 ng/L) and 5-HT (151.70 ± 18.86 ng/L) between the study group and control group (113.29 ± 15.01 UG/L, 273.91 ± 40.04 ng/L, 148.85 ± 20.45 ng/L) before the operation ($P > 0.05$). After the operation, there was no significant difference in serum NPY (153.13 ± 16.91 UG/L) and PGE2 (313.76 ± 40.64 ng/L), and the level of 5-HT (218.78 ± 22.65 ng/L) was lower than that in the control group (178.68 ± 20.51 UG/L, 369.78 ± 44.37 ng/L, 267.64 ± 30.74 ng/L) ($P < 0.05$, [Table 3](#)).

Comparison of the incidence of complications between the two groups

The incidence of complications in the study group (4.17%) was lower than that of the control group (18.75%) ($P < 0.05$, [Table 4](#)).

DISCUSSION

In recent years, with the improvement of living standards, changes in diet and lifestyle have led to a significant increase in CRC incidence rate, and the trend in the population tends to be younger[7]. According to recent statistical data, the incidence rate of CRC ranks third in the overall incidence of malignant tumors, with the mortality rate ranked fifth[8].

At present, in clinical settings, it is generally accepted that the treatment principle of CRC is to remove tumor lesions and lymph nodes, inhibit tumor metastasis and infiltration, and improve the survival rate of patients[9]. Surgery is an important clinical treatment for CRC, and traditional open radical resection of CRC plays an important role in removing tumor lesions and clearing lymph node tissue. However, its trauma is large, and the risk of postoperative intestinal obstruction and incision infection is high, which is not conducive to early recovery of bodily functions, resulting in limitations in its clinical application[10,11]. However, with improvement in medical technology, laparoscopic-assisted radical resection of CRC has gradually played an important role in CRC. It has little trauma and a clear operating field, which is convenient for the accurate implementation of relevant treatment operations [12,13]. However, some studies have reported that laparoscopic technology is not yet fully developed and is difficult to operate, so its application is controversial[14]. According to the present study, the operating time in the study group was longer than that in the control group, but other related indices were superior to those in the control group. The incidence of complications was lower than that of the control group, and there was no significant difference in lymph node dissections between the two groups, verifying that laparoscopic radical resection of CRC can achieve good efficacy and reduce surgical trauma and incidence of complications, which is conducive to early rehabilitation of bodily functions. The reasons may be as follows: (1) in laparoscopic radical resection of CRC, endoscopic treatment can provide a clear operating field for the operator, facilitate the rapid and accurate discovery of diseased tissues, reduce the damage to surrounding organs and tissues, and reduce the occurrence of complications and the impact on the physiological function of the body; (2) laparoscopic radical resection of CRC can reduce the traction injury to the tissue and the injury risks, such as surrounding important organs, blood vessels and tissues, reduce intraoperative blood loss and shorten the recovery time of bodily functions after operation; and (3) laparoscopic radical resection of CRC can avoid long-term exposure of organs, reduce mechanical traction injury of organs and gastrointestinal stress response, and shorten postoperative functional rehabilitation[15]. In addition, some studies have

Table 1 Comparison of perioperative conditions between the two groups (mean \pm SD)

Groups	Cases	Operating time (min)	Intraoperative blood loss (mL)	Recovery time of gastrointestinal function (h)	No. of lymph node dissections (bout)	Hospital stay (d)
Study group	48	186.18 \pm 33.54	111.34 \pm 21.45	25.35 \pm 4.55	15.19 \pm 3.04	10.09 \pm 2.38
Control group	48	129.38 \pm 26.83	163.77 \pm 32.41	36.06 \pm 7.13	16.20 \pm 2.98	13.51 \pm 3.66
<i>t</i>		9.162	9.346	8.773	1.643	5.427
<i>P</i>		0.000	0.000	0.000	0.104	0.000

Table 2 Comparison of inflammatory response index levels before and after the operation between the two groups (mean \pm SD)

Time	Groups	Cases	CRP (mg/L)	IL-6 (ng/mL)	IL-8 (ng/L)	IL-10 (ng/L)
Before the operation	Study group	48	7.98 \pm 2.33	9.79 \pm 4.11	3.79 \pm 1.71	48.96 \pm 12.51
	Control group	48	8.29 \pm 2.60	10.56 \pm 3.78	4.08 \pm 1.45	50.13 \pm 11.67
	<i>t</i>		0.615	0.955	0.896	0.474
	<i>P</i>		0.540	0.342	0.373	0.637
After the operation	Study group	48	14.91 \pm 5.56	19.11 \pm 6.68	12.61 \pm 3.69	36.48 \pm 9.39
	Control group	48	21.79 \pm 7.33	34.03 \pm 9.40	16.67 \pm 4.54	28.39 \pm 7.61
	<i>t</i>		5.181	8.964	4.808	4.637
	<i>P</i>		0.000	0.000	0.000	0.000

CRP: C-reactive protein; IL: Interleukin.

Table 3 Comparison of pain stress response indexes before and after operation between the two groups (mean \pm SD)

Time	Groups	Cases	NPY (g/L)	PGE2 (ng/L)	5-HT (ng/L)
Before the operation	Study group	48	109.79 \pm 13.46	269.54 \pm 37.34	151.70 \pm 18.86
	Control group	48	113.29 \pm 15.01	273.91 \pm 40.04	148.85 \pm 20.45
	<i>t</i>		1.203	0.553	0.710
	<i>P</i>		0.232	0.582	0.480
After the operation	Study group	48	153.13 \pm 16.91	313.76 \pm 40.64	218.78 \pm 22.65
	Control group	48	178.68 \pm 20.51	369.78 \pm 44.37	267.64 \pm 30.74
	<i>t</i>		6.659	6.450	8.865
	<i>P</i>		0.000	0.000	0.000

NPY: Neuropeptide; PGE2: Prostaglandin E2; 5-HT: 5-hydroxytryptamine.

suggested that endoscopy has a certain amplification effect. Doctors can explore the abdominal cavity from multiple angles with the help of endoscopy, which can reduce the difficulty of distinguishing the pelvic and abdominal fascia space, and observe the parts that are difficult to be observed by traditional laparotomy, so as to accurately implement relevant procedures and protect the pelvic autonomic nerve function[16,17]. The reason for the long operating time for laparoscopic radical resection of CRC may be the high complexity of the operation, which transforms the surgical field from three-dimensional to one-sided. The operator needs to perceive the relevant conditions of the lesions through instruments, which increases the difficulty of surgical treatment to a certain extent, so it will prolong the operating time.

Surgical procedures can be a source of exogenous stress response and produce trauma and trigger different degrees of inflammatory response and pain stress response. The latter is closely related to the degree of inhibition of immune function. Therefore, it is important to evaluate the state of inflammatory response and pain stress response before and after surgery. IL-6 and IL-8 are typical inflammatory

Table 4 Comparison of the incidence of complications between the two groups, *n* (%)

Groups	Cases	Anastomotic leakage	Ileac passion	Infection of incisional wound	Deep vein thrombosis	Total incidence rate
Study group	48	1 (2.08)	0 (0.00)	1 (2.08)	0 (0.00)	2 (4.17)
Control group	48	3 (6.25)	2 (4.17)	3 (6.25)	1 (2.08)	9 (18.75)
χ^2						5.031
<i>P</i>						0.025

factors, which can take part in the inflammatory reaction. IL-10 is an anti-inflammatory factor, and its serum content can increase abnormally when the body has an inflammatory reaction. CRP is an acute phase reactive protein that can increase abnormally after trauma. NPY, PGE2 and 5-HT are important indicators for clinical evaluation of pain stress. Their serum concentration is low under normal physiological conditions, but trauma from invasive surgery can result in abnormal increases of the above indicators. There is a positive correlation between the degree of increase and the degree of pain stress response[18-20]. This study showed that, after the operation, the levels of IL-6, IL-8, CRP, NPY, PGE2 and 5-HT in the study group were lower than in the control group, and the IL-10 level was higher than in the control group. From the perspective of serum factors, laparoscopic radical resection of CRC can reduce inflammatory reaction and pain stress reaction, and is an effective and safe surgical treatment.

CONCLUSION

Laparoscopic radical resection of CRC can reduce surgical trauma, reduce inflammatory response and pain stress response caused by surgical treatment, which is conducive to shortening the rehabilitation process of patients, with a low incidence of complications, and good safety.

ARTICLE HIGHLIGHTS

Research background

The incidence of colorectal cancer (CRC) is a serious threat to the health and quality of life of patients. In the treatment of CRC, both laparoscopy and radical resection are widely used.

Research motivation

This study provided a reference for CRC treatment.

Research objectives

This study aimed to investigate the clinical efficacy and postoperative inflammatory response of laparoscopic and open radical resection of CRC.

Research methods

A total of 96 patients with CRC from March 2016 to April 2021 were selected, and were divided into the study group (*n* = 48) and control group (*n* = 48) using a simple random method.

Research results

The operating time in the study group was longer than that of the control group, but the intraoperative blood loss, recovery time of gastrointestinal function, and hospital stay were better than those in the control group. The incidence of the complications in the study group was lower than that of the control group.

Research conclusions

Laparoscopic radical resection of CRC can reduce surgical trauma, reduce inflammatory response and pain stress response caused by surgical treatment, which is conducive to shortening the rehabilitation of patients, with a low incidence of complications, and good safety.

Research perspectives

Laparoscopic radical resection of CRC can achieve wider clinical application.

FOOTNOTES

Author contributions: He LH and Yang B design the experiment; Su XQ drafted the manuscript; Zhou Y, Zhang Z and He LH collected the data; Yang B and Su XQ analyzed and interpreted data; Zhou Y, Zhang Z and He LH wrote and revised the manuscript.

Institutional review board statement: This study was approved by the First People's Hospital of Wanzhou District Ethics Committee.

Informed consent statement: Patients were not required to give informed consent to the study because the analysis used anonymous clinical data that were obtained after each patient agreed to treatment by written consent.

Conflict-of-interest statement: The authors declared that there is no conflict of interest between them.

Data sharing statement: No additional data are available.

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Country/Territory of origin: China

ORCID number: Long-Hai He 0000-0002-7761-5826; Bo Yang 0000-0002-6951-4865; Xiao-Qin Su 0000-0001-9755-8585; Yue Zhou 0000-0002-6013-7645; Zhen Zhang 0000-0002-3772-5529.

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