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Clinical effect of laparoscopic surgery on patients with colon cancer complicated with intestinal obstruction.

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Keywords: colon cancer; intestinal obstruction; laparoscopic.

Abstract. Colon cancer is a malignant tumor of the digestive tract, often complicated by intestinal obstruction. Laparoscopic surgery is widely used and has the advantages of a small postoperative wound, less intraoperative blood loss, and fewer postoperative complications. To measure the clinical effect of laparoscopic surgery on patients with colon cancer complicated with intestinal obstruction, the clinical data of 100 patients with this condition, who underwent surgical treatment in the Baoji High-tech Hospital between January 2020 and December 2022, were retrospectively analyzed. Based on different surgical methods, the patients were separated into a control group (CG, traditional laparotomy) and an observation group (OG, laparoscopic surgery). The total clinical effect of OG was superior to that of CG, as evidenced by shorter operation times, reduced intraoperative blood loss, faster recovery times for intestinal function, earlier discharge from bed, and shorter hospital stays. After surgery, the NRS score declined in both groups, with a lower score in the OG. TNF-α, IL-6, and CRP levels were elevated in both groups, but those in OG were lower. The occurrence of complications in the OG was reduced compared to the CG. Quality-of-life scores, including physical function, psychological state, social communication, and self-care ability in the OG, were higher than those in the CG. Laparoscopic surgery is effective for treating colon cancer complicated with intestinal obstruction in patients, which can effectively lessen their pain, reduce their inflammatory indicators, reduce the postoperative complications of patients, and improve their quality of life.

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Efecto clínico de la cirugía laparoscópica en pacientes con cáncer de colon complicado con obstrucción intestinal.

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Palabras clave: cáncer de colon; obstrucción intestinal; laparoscopía.

Resumen. El cáncer de colon es un tumor maligno del tracto digestivo, a menudo complicado por obstrucción intestinal. La cirugía laparoscópica se utiliza ampliamente y presenta ventajas tales como una herida postoperatoria pequeña, menor pérdida de sangre intraoperatoria y menos complicaciones postoperatorias. El objetivo de este estudio fue evaluar el efecto clínico de la cirugía laparoscópica en pacientes con cáncer de colon complicado con obstrucción intestinal. Se analizaron retrospectivamente los datos clínicos de 100 pacientes con cáncer de colon complicado con obstrucción intestinal que se sometieron a tratamiento quirúrgico en el Hospital de Alta Tecnología de Baoji entre enero de 2020 y diciembre de 2022. Según los diferentes métodos quirúrgicos, los pacientes se dividieron en un grupo control (GC, laparotomía tradicional) y un grupo de observación (GO, cirugía laparoscópica). El efecto clínico total del GO fue mejor que el del GC; el tiempo operatorio, la pérdida de sangre intraoperatoria, el tiempo de recuperación de la función intestinal, el tiempo para levantarse de la cama y la estancia hospitalaria fueron menores en el GO. Después de la cirugía, la Puntuación de la Escala de Riesgo Nutricional disminuyó en ambos grupos, siendo más baja en el GO. Los niveles de TNF-α, IL-6 y la Proteína C reactiva se elevaron en ambos grupos, pero fueron más bajos en el GO. La aparición de complicaciones fue menor en el GO que en el GC. Las puntuaciones de calidad de vida, incluyendo función física, estado psicológico, comunicación social y capacidad de autocuidado, fueron más altas en el GO que en el GC. La cirugía laparoscópica es eficaz para tratar a pacientes con cáncer de colon complicado con obstrucción intestinal, ya que puede reducir eficazmente el dolor, los indicadores inflamatorios, las complicaciones postoperatorias y mejorar la calidad de vida de los pacientes.

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INTRODUCTION

Colon cancer is a malignant tumor of the digestive tract that primarily occurs in the colon, particularly at the junction of the sigmoid colon and the rectum [1]. Its incidence is extremely high, ranking as high as the third in the ranking of gastrointestinal tumors [2]. Intestinal obstruction is a relatively common complication of colon cancer[3]. The primary cause of intestinal obstruction in patients with colon cancer is the tumor's narrowing of the intestinal cavity, resulting in dry and hard stool that impedes the passage of intestinal contents [4]. The early symptoms of acute intestinal obstruction are insidious and difficult to detect, and the development of acute intestinal obstruction is rapid after onset, which can easily lead to death [5]. At present, surgery is often used in the clinical therapy of colon cancer complicated with intestinal obstruction [6]. However, traditional laparotomy not only easily leads to large wounds, but is also prone to more complica-

tions, which have adverse effects on the rapid recovery of patients [7,8]. Laparoscopic surgery has been widely used in the surgical therapy of colon cancer complicated with intestinal obstruction patients due to its advantages of small postoperative wound, less intraoperative blood loss, fewer postoperative complications, and quick postoperative recovery [9]. The objective of this study was to investigate further the effect of laparoscopic surgery on patients with colon cancer complicated with intestinal obstruction.

MATERIALS AND METHODS

Patients

The clinical data of 100 colon cancer patients complicated with intestinal obstruction who underwent surgical treatment in our hospital from January 2020 to December 2022 were retrospectively analyzed. Based on different surgical methods, the patients were separated into a control group (CG) and an observation group (OG), with 50 cases in each group.

Inclusion criteria: (1) Patients diagnosed with colon cancer combined with intestinal obstruction; (2) The patient had not received any other treatment before surgery.

Exclusion criteria: (1) Patients with malignant tumors of other sites; (2) Patients with abnormal heart, liver and kidney function; (3) Patients who had received open surgery; (4) Intestinal perforation. No significant difference was discovered in baseline data between the two groups ($p>0.05$), reflecting comparability, as shown in Table 1.

Treatments

Both groups underwent general anesthesia before surgery, and artificial pneumoperitoneum with a pressure of about 15 mmHg was established. Different surgical positions were taken according to the different locations of the colon cancer tumor and intestinal obstruction.

The CG received a traditional laparotomy. The surgical approach was to make an incision in the middle of the lower abdomen of the patient. The incision was made successively according to subcutaneous tissue levels, and the abdominal tumor and intestinal obstruction sites were carefully observed to determine their size, location, and adjacent tissues, to select the resection method for resection of the tumor, intestine and lymph nodes. After resection, the bleeding status of the patient was checked, and abdominal cleaning was performed. The surgical incision was sutured layer by layer, and the drainage tube was placed. After laparotomy, the patients were treated with routine anti-infection therapy and fluid rehydration.

The OG was treated with laparoscopic surgery. Puncture was performed on the left and right sides below the belly button of the patient, with a length of about 10 mm. The laparoscope was placed in the abdomen of the patient, and the abdominal tumor and intestinal obstruction were observed under the laparoscope. Then, the left and right sides of the upper abdomen of the patient were selected for puncture, and a Trocar with a length of about 5 mm was placed in them. The size, location, and adjacent tissues of the tumor

Table 1. General data of patients in both groups.

Indicators		Control group (n=50)	Observation group (n=50)	p
Gender (male/female)		30/20	29/21	>0.05
Average age (years)		52.93±8.35*	53.06±8.47*	>0.05
TNM stage	Stage I	20	21	>0.05
	Stage II	25	24	
	Stage III	5	5	

* Mean ± standard deviation. TNM: tumor/node/metastasis.

and intestinal obstruction were determined under the laparoscope, and the primary and secondary operation holes were established according to them. Thus, intestinal adhesion lysis was performed, the tumor intestines and lymph nodes were removed, and the abdominal cavity of the patient was rinsed with normal saline, and the surgical incision was sutured layer by layer. After laparoscopic surgery, the patients were treated with routine anti-infection and fluid rehydration.

Observation indicators

(1) Evaluation of clinical effects. *Cure*: after treatment, the patient's clinical symptoms and pathological tumor disappeared, X-ray examination showed no intestinal dilation in the abdomen, incision healing without complications; *Improvement*: the clinical symptoms were significantly improved, the lesion and tumor were reduced by more than half, and the abdominal intestinal obstruction was partially relieved by X-ray examination. *Ineffective*: those who do not meet the above criteria or whose disease worsens. Total effective rate = cure rate + improvement rate.

(2) Evaluation of surgical indicators. The operation time, intraoperative blood loss, recovery time of intestinal function, time of getting out of bed and hospital stay of patients were observed and recorded.

(3) Pain score was evaluated using a numerical rating scale (NRS). The total score was 0-10 points.

(4) Inflammatory factors. 5 mL of fasting peripheral blood was gathered from patients before and three days after surgery in the morning, respectively. Serum was collected after centrifugation, and the serum levels of TNF-α, IL-6, as well as CRP, were examined employing double-antibody sandwich enzyme-linked immunosorbent assay (ELISA).

(5) The occurrence of complications, including pulmonary infection, incision infection, intra-abdominal hemorrhage and anastomotic fistula in both groups was compared.

(6) The postoperative quality of life score of the two groups was compared, including: physical function, psychological state, social communication, as well as self-care ability, 25 points for each item, a total score of 0 ~ 100 points.

Statistical analysis

This experiment was conducted with SPSS 22.0 statistical analysis software. The measurement data of normal distribution were exhibited as (x±sd), and the t-test was adopted for analysis. The count data were expressed as a rate (%), and a χ^2 test was performed between groups, $p<0.05$ meant the difference was statistically significant.

RESULTS

Clinical effect

Table 2 displayed that the total clinical effect of the OG presented better when comparing with the CG ($p<0.05$).

Surgical indicators in both groups

The operation time, intraoperative blood loss, recovery time of intestinal function, time of getting out of bed and hospital stay of patients in the OG presented shorter relative to the CG (Table 3).

Table 2. Clinical effect.

Groups	N	Cure	Improvement	Ineffective	Total effective rate
Control group	50	20	22	8	42 (84.00%)*
Observation group	50	26	23	1	49 (98.00%)
$\chi2$					5.983
p					<0.05

* Data expressed as n(%).

Table 3. Surgical indicators.

Indicator	Control group	Observation group	p*
Operation time (min)	120.0 ± 13.4*	90.0 ± 11.6	<0.05
Intraoperative blood loss (mL)	300.0 ± 45.3	150.0 ± 30.2	<0.05
Recovery of intestinal function (days)	4.2 ± 0.7	2.8 ± 0.6	<0.05
Time of getting out of bed (days)	2.3 ± 0.5	1.5 ± 0.4	<0.05
Hospital stay (days)	9.6 ± 1.4	6.2 ± 1.0	<0.05

Data expressed as mean±standard deviation *t-Student test.

Degree of pain

No difference was seen in NRS score between the two groups before surgery (p>0.05). After surgery, the NRS score declined in both groups, and that in the OG was lower when compared with the CG (Table 4).

Table 4. Degree of pain.

Group	NRS (Pre-op)	NRS (Post-op)	p*
Control group	6.5 ± 0.9	4.2 ± 0.7	<0.05
Observation group	6.4 ± 1.0	2.7 ± 0.6	<0.05

NRS: numerical rating scale. Data expressed as mean ± standard deviation * t-Student test.

Inflammatory response

No difference was seen in TNF-α, IL-6, and CRP levels between the two groups before surgery (p>0.05). After surgery, TNF-α, IL-6, and CRP levels were increased in both groups, but those in the OG presented lower when compared with the CG (Table 5).

Occurrence of complications

Table 6 displayed that the occurrence of complications in the OG was lower when compared with the CG (p<0.05).

Quality of life

After surgery, the quality of life scores, including physical function, psychological state, social communication, as well as self-care ability in the OG, were higher when compared with the CG (Table 7).

Table 5. Inflammatory response.

Marker	CG Pre-op	CG Post-op	OG Pre-op	OG Post-op	p*
TNF-α (pg/mL)	15.3 ± 2.1	35.6 ± 4.5	15.1 ± 2.0	28.4 ± 3.6	<0.05
IL-6 (pg/mL)	24.1 ± 3.2	49.8 ± 5.3	23.9 ± 3.4	36.2 ± 4.0	<0.05
CRP (mg/L)	18.7 ± 2.8	44.2 ± 5.8	18.4 ± 2.9	30.1 ± 4.7	<0.05

CG: Control group, OG: Observation group. Data expressed as mean±standard deviation* t- Student test between Pre-op and Post-op.

Table 6. Occurrence of complications.

Groups	N	Pulmonary infection	Incision infection	Intra-abdominal hemorrhage	Anastomotic fistula	Total incidence rate
Observation group	50	1	0	1	1	3 (6.00%)*
Control group	50	3	2	3	3	11 (22.00%)
χ^2						5.316
p						<0.05

*Data expressed as n(%).

Table 7. Quality of life

Domain	Control group	Observation group	p*
Physical function	17.5 ± 2.0	22.4 ± 1.8	<0.05
Psychological state	18.2 ± 1.9	23.1 ± 2.1	<0.05
Social communication	17.9 ± 2.3	22.6 ± 1.7	<0.05
Self-care ability	18.0 ± 2.4	23.2 ± 1.9	<0.05

Data expressed as mean±standard deviation *t-Student test.

DISCUSSION

Intestinal obstruction is one of the most common clinical complications of colon cancer, the cause of which is closely related to postoperative infection and intestinal adhesion in patients with this condition [9]. The clinical symptoms are often manifested as abdominal distension, constipation and vomiting, etc. [10] Because the early symptoms of intestinal obstruction are not easy to detect, and the development rate after the onset of the disease is fast, it has a significant adverse influence on the survival, quality of life and postoperative recovery of patients [11].

At present, surgery is usually used in the clinical therapy of colon cancer complicated with intestinal obstruction, and the curative effect is exact; the tumor can be removed in one time, and the obstruction can be removed in one time [12]. Traditional laparotomy is the leading choice for the clinical therapy of colon cancer complicated with intestinal obstruction, which has good therapeutic effect and can effectively remove the tumor and relieve the intestinal obstruction of patients [13]. However, the traditional open surgery will leave a large wound and multiple postoperative complications, resulting in a slow postoperative recovery [14]. Therefore, in the therapy of colon cancer patients with intestinal obstruction, it is imperative to adopt a surgical treatment with minor postoperative wounds, fewer postoperative complications, and rapid postoperative recovery, which not only improves the survival rate of patients but also promotes their quality of life.

In recent years, minimally invasive surgery has been extensively applied in abdominal surgery, and laparoscopic surgery, as a minimally invasive surgery, has been widely used in clinical treatment for its advantages of small postoperative wound, less intraoperative blood loss, fewer postoperative complications and quick postoperative recovery [15]. In treating colon cancer complicated with intestinal obstruction in patients, laparoscopic surgery can be used to observe the patient's abdominal cavity through a video probe [16]. At the same time, the magnification of laparoscopy can effectively ensure the surgical field of view, so that the patient's lesion area is fully and clearly exposed [17]. Moreover, laparoscopy offers the advantage of multi-angle exploration, allowing for the clear exposure of positions that are not readily observable in traditional open surgery, thereby facilitating detailed and precise surgical operations [18]. In addition, laparoscopic surgery can effectively decrease operation time, reduce postoperative wounds, and decrease intraoperative blood loss and postoperative complications, thereby speeding up the patient's recovery [19].

Our study indicated that the total clinical effect of the OG was better when compared with the CG. The operation time, intraoperative blood loss, recovery time of intestinal function, time of getting out of bed and hospital stay of patients in the OG were shorter relative to the CG. The NRS score declined in both groups, with the OG presenting lower scores when compared to the CG. All these outcomes indicated that the application of laparoscopic surgery could shorten the length of hospital stay, reduce the amount of intraoperative blood loss, alleviate the pain of patients, improve the efficiency of clinical treatment, and promote the rehabilitation process of patients in treating colon cancer complicated with intestinal obstruction. Consistently, Ruben Veldkamp et al. [20] have indicated that lapa-

roscopic colectomy is linked to earlier recovery of bowel function, a lower requirement for analgesics, and a shorter hospital stay relative to open colectomy [20].

During surgical trauma, patients would also activate the inflammatory response and promote the secretion of inflammatory factors [21]. TNF-α is a pro-inflammatory factor, which is secreted by mononuclear macrophages. IL-6 is a crucial cytokine that regulates intercellular immunity and cooperates with other cytokines in patients to transmit an inflammatory response, serving as a key indicator for evaluating the degree of surgical trauma in patients [22]. CRP is an important mediator of acute inflammation. When patients suffer from surgical trauma, the level of their pain will be significantly increased, which dramatically improves the tissue repair ability of patients [23]. However, research in this field has found that CRP levels in patients are positively linked to the degree of surgical trauma [24]. Our study indicated that after surgery, TNF-α, IL-6, and CRP levels increased in both groups. However, those in the OG were lower when compared with the CG, suggesting that the use of laparoscopic surgery could inhibit the inflammatory response in colon cancer patients complicated with intestinal obstruction. Consistently, it has been reported that the inflammatory response is lower in laparoscopic rectal surgery when compared with conventional open surgery [25].

In addition, our study indicated that the occurrence of complications in the OG was lower when compared with the CG, and the quality of life scores, including physical function, psychological state, social communication, as well as self-care ability in the OG, were higher when compared with the CG. All above outcomes indicated that the application of laparoscopic surgery could reduce the complications and promote the quality of life of patients with colon cancer complicated with intestinal obstruction, which was in agreement with previous studies [26]. As a conclusion, laparoscopic surgery significantly impacts the treatment of colon cancer patients with intestinal obstruction, effectively reducing patient pain, lowering inflammatory indicators, minimizing postoperative complications, and improving the patient's quality of life.

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Ethical considerations

The Medical Ethics Committee of the Baoji High-tech Hospital approved this work.

Conflict of interests

There are no conflicts of interest in this study.

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Author's contributions

PW was responsible for concepting the study, collecting, analyzing data, and drafting the manuscript. ZT revised the manuscript and managed the data.

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