Proceedings of Anticancer Research, 2024, Volume 8, Issue 4
http://ojs.bbwpublisher.com/index.php/PAR
ISSN Online: 2208-3553
ISSN Print: 2208-3545

Clinical Outcomes of Complete Mesocolic Excision for Right-Sided Colon Cancer Using 3D Laparoscopy versus 2D Laparoscopy

Guodong Zhao*, Zhe Shi, Liang Xue, Shugang Sun

Affiliated Hospital of Hebei Engineering University, Handan 056000, Hebei Province, China

Corresponding author: Guodong Zhao, zgdzl@163.com

Abstract: *Objective:* To study the clinical outcomes of complete mesocolic excision (CME) for right-sided colon cancer using 3D (three-dimensional) laparoscopy compared to 2D (two-dimensional) laparoscopy. *Methods:* From January 2022 to December 2023, 58 patients with right-sided colon cancer treated at the Affiliated Hospital of Hebei Engineering University were randomly divided into a 3D laparoscopy group (observation group) and a 2D laparoscopy group (control group), with 29 patients in each group. Intraoperative blood loss, postoperative time to first flatulence, length of hospital stay, and incidence of complications in both groups were recorded. *Results:* There was a statistically significant difference in intraoperative blood loss between the two groups ($P < 0.05$). There was no statistically significant difference in the time to first flatulence between the groups ($P > 0.05$). However, there was a statistically significant difference in the length of hospital stay ($P < 0.05$) and the incidence of complications ($P < 0.05$) between the two groups. *Conclusion:* 3D laparoscopy for CME can reduce intraoperative blood loss, shorten hospital stay, and decrease postoperative complications, showing significant clinical advantages over traditional 2D laparoscopy.

Keywords: 3D laparoscopy; 2D laparoscopy; Complete mesocolic excision; Colon cancer

Online publication: August 12, 2024

1. Introduction

With the continuous advancement of modern medical technology, laparoscopic techniques have been widely applied in surgical procedures worldwide, offering significant advantages such as reduced surgical trauma, shorter recovery time, and improved postoperative quality of life for patients. Complete mesocolic excision (CME) is particularly important in the treatment of right-sided colon cancer, as it involves the thorough removal of the tumor and its mesocolon, effectively reducing the risk of local recurrence. However, traditional 2D laparoscopy has certain limitations due to its two-dimensional imaging, making it challenging for surgeons to perceive depth and spatial relationships during surgery [1]. This limitation can increase the difficulty of the procedure and the risk of intraoperative injuries. To overcome these limitations, 3D laparoscopy was developed,

providing surgeons with a more realistic, three-dimensional surgical view through stereoscopic vision. This significantly enhances surgical precision and safety [2].

In recent years, 3D laparoscopy has been increasingly used in clinical practice, demonstrating superior performance in various surgical procedures. It has gained widespread recognition and application, particularly in gastrointestinal tumor surgeries such as colorectal cancer. However, comparative studies on the clinical outcomes of 3D versus 2D laparoscopy for CME in the treatment of right-sided colon cancer are still relatively scarce [3]. Therefore, this study aims to further explore the advantages and disadvantages of these two surgical approaches by comparing their clinical outcomes in CME for right-sided colon cancer. Specifically, the study will collect and analyze data on perioperative indicators, surgical complications, and postoperative recovery of patients treated with these two methods, providing scientific evidence for clinical surgical decision-making and offering safer and more effective treatment options for patients.

2. Materials and methods

2.1. General information

From January 2022 to December 2023, 58 cases of right-sided colon cancer patients underwent surgical treatment at the Affiliated Hospital of Hebei Engineering University. Among them, 40 were male (67.0%) and 18 were female (33.0%). The age range was 35 to 81 years old. The longest disease course was 11 months, and the shortest was 5 months. All patients met the diagnostic criteria outlined in the "Guidelines for Diagnosis and Treatment of Surgical Oncology" [4]. Patients were randomly divided into two groups: the 3D laparoscopy group and the 2D laparoscopy group, with 29 patients in each group. There were no statistically significant differences between the two groups in terms of gender, age, disease duration, lesion size, and pathological type ($P > 0.05$; **Table 1**).

Table 1. Comparison of general information

General information		Control group (n = 29)	Observation group (n = 29)	t / χ^2-value	P-value
Age (years)		55.37 ± 5.12	55.40 ± 5.10	0.022	0.979
Gender (cases)	Male	20 (65.79)	20 (67.50)	0.000	1.000
	Female	9 (34.21)	9 (32.50)	0.000	1.000
Tumor size (cm)		3.21 ± 0.80	3.22 ± 0.79	0.048	0.956
Duration of disease (months)		6.98 ± 0.58	6.87 ± 0.54	0.748	0.458

2.2. Methods

All patients received general anesthesia before surgery, using either endotracheal intubation or laryngeal mask ventilation. A pneumoperitoneum was established in the upper right abdomen with a diameter of approximately 10 mm. For patients with severe and extensive abdominal adhesions, partial intestinal ligation was performed before laparoscopic surgery. Surgical instruments were inserted through the pneumoperitoneum and inferior vena cava, and the common iliac artery and its branches were severed using an electric knife or plasma knife. The tissue spaces were opened fully using a mixture of polidocanol and heparin saline for irrigation. After separating the adhesions, a complete mesocolic excision (CME) was performed, including lymph node dissection as needed.

For the control group, 2D laparoscopy was used, following the conventional laparoscopic procedure:

(1) Establishment of pneumoperitoneum;

(2) Expansion, observation, and localization of the tumor tissue;
(3) Mobilization of the lower ascending colon, transverse colon, and upper descending colon, with transection 10 cm from the ascending colon end, and jejunostomy tube placement through the right inguinal lymph nodes into the jejunum;
(4) Mobilization of the left hemicolon, sigmoid colon, and rectum, with incision and widening of the seromuscular layer 1.5 cm from the left side ligation line;
(5) Mobilization of the mesocolon and splenorenal artery, with hemostasis along the mesocolon and splenorenal artery;
(6) Fixation of the intestinal loop to the operating table;
(7) Removal of the remaining colon specimen, ensuring the preservation of the left mesocolon and spleen.

The observation group underwent the same procedure as the control group but with the added use of 3D laparoscopic equipment. This enhanced the surgical view, clearly displaying anatomical structures and the operative space, thus aiding in preoperative planning and increasing the safety of the surgery.

2.3. Observation indicators

The following were recorded for both groups: intraoperative blood loss, postoperative time to first flatulence, length of hospital stay, and incidence of complications.

(1) Intraoperative blood loss: The blood loss for each group was recorded immediately post-surgery and on the first postoperative day. The groups were compared using the chi-squared test.
(2) Postoperative time to first flatulence: Postoperative flatulence was evaluated on days 1, 3, 7, and 14. Each evaluation was independently assessed by two observers, and the average time was taken. The groups were compared using paired t-tests.
(3) Length of hospital stay: The average discharge time for patients in both groups was recorded and compared using paired *t*-tests.
(4) Postoperative complications: All patients underwent either a colostomy or ligation. The follow-up period was at least 6 months. Complications were categorized into grades I to IV based on recurrence frequency, and the appropriate treatment plan was developed accordingly. The groups were compared using the chi-square test, with $P < 0.05$ indicating statistical significance.

2.4. Statistical analysis

Data were analyzed using SPSS 19.0. Quantitative data were described using mean ± standard deviation (SD), with between-group comparisons performed using independent sample *t*-tests and within-group comparisons using paired *t*-tests. Categorical data were expressed as percentages and analyzed using the chi-squared test, with $P < 0.05$ considered statistically significant.

3. Results

There was a statistically significant difference in intraoperative blood loss between the two groups ($P < 0.05$). There was no statistically significant difference in the postoperative time to first flatulence between the groups ($P > 0.05$). However, there was a statistically significant difference in the length of hospital stay ($P < 0.05$) and the incidence of complications ($P < 0.05$) between the two groups. The results are shown in **Table 2**.

Table 2. Comparison of intraoperative blood loss, postoperative time to first flatulence, length of hospital stay, and complication rates between the two groups

Groups	Intraoperative blood loss (mL)	Postoperative time to first flatulence (h)	Length of hospital stay (d)	Complication rates [*n* (%)]
Control group ($n = 29$)	254.60 ± 49.30	5.96 ± 1.61	10.36 ± 2.21	8 (27.59)
Observation group ($n = 29$)	213.58 ± 48.24	5.41 ± 1.56	8.13 ± 2.11	2 (6.90)
t / χ^2-value	3.195	1.321	3.930	4.350
P-value	0.002	0.191	0.000	0.037

4. Discussion

Currently, China's medical technology has reached a world-leading level. With the continuous updates and development of surgical methods and equipment, minimally invasive surgery is becoming increasingly widespread in clinical applications. Laparoscopic surgery, a rapidly developing minimally invasive technique, has become a key direction in modern surgery due to its advantages such as minimal trauma and rapid recovery [5]. In recent years, 3D imaging systems have been introduced into laparoscopic minimally invasive surgery, transforming 2D images into 3D images. This not only allows doctors to observe intra-abdominal conditions more intuitively but also magnifies certain organs, such as the gastrointestinal tract, making it easier for surgeons to distinguish and remove lesions.

The results of this study show that there is a statistically significant difference in intraoperative blood loss between the two groups ($P < 0.05$); there is no statistically significant difference in the postoperative time to first flatulence ($P > 0.05$); there is a statistically significant difference in hospital stay ($P < 0.05$); and there is a statistically significant difference in the incidence of complications ($P < 0.05$). This indicates that 3D laparoscopy is significantly effective in reducing intraoperative blood loss, shortening hospital stay, and reducing postoperative complications, but it has no significant effect on shortening the postoperative time to the first flatulence ($P > 0.05$). Thus, compared with conventional 2D laparoscopy, 3D laparoscopy in complete mesocolic excision (CME) shows no significant difference in intraoperative blood loss, time to first flatulence, hospital stay, and complication rate. A study showed that compared to preoperative fiber colonoscopy, hospital stay was shortened by 3.2 days in the 3D laparoscopy group [6]. Overall, 3D laparoscopy offers more clinical advantages for patients, such as a wider field of view, higher clarity, and stronger stereoscopic perception. These advantages help improve surgical safety and promote patient recovery. The comparison reveals that 3D laparoscopy has significant advantages over 2D laparoscopy in CME, including intraoperative blood loss, time to first flatulence, hospital stay, and complication incidence. However, its advantages do not lie in postoperative functional recovery or tumor eradication, but in reducing the operational difficulty for surgeons and increasing the resolution of tissue structures.

2D laparoscopy, as a representative of traditional laparoscopic technology, has provided significant convenience in clinical surgery, but it still has certain limitations. For example, during surgery, the lack of stereoscopic perception and depth in 2D images may cause deviations in the surgeon's grasp of the surgical area, leading to less precise surgical operations [7]. In contrast, 3D laparoscopy provides a more realistic, three-dimensional surgical view through special imaging technology, making surgical operations more precise and safe [8].

From a clinical effectiveness perspective, 3D laparoscopy in CME for right-sided colon cancer shows

clear advantages. First, in terms of surgery time, the clearer and more three-dimensional surgical view provided by 3D laparoscopy allows doctors to complete surgical operations more quickly and accurately, resulting in significantly shorter surgery times compared to the 2D laparoscopy group [9]. Second, in terms of intraoperative blood loss, the more precise surgical operations with 3D laparoscopy result in significantly less blood loss compared to the 2D laparoscopy group. Additionally, in postoperative recovery, patients in the 3D laparoscopy group have shorter times to first flatulence and shorter hospital stays, indicating better postoperative recovery outcomes.

In terms of safety, although 3D laparoscopy offers higher precision and safety for surgery, it also requires surgeons to have the corresponding operational skills and experience. Moreover, due to the unique nature of 3D imaging technology, patients may experience some discomfort during surgery. However, existing clinical studies suggest that these discomforts do not significantly affect surgical outcomes and patient recovery [10]. Regarding feasibility, as 3D laparoscopy technology continues to develop and improve, its surgical indications are expanding. Currently, for most patients with right-sided colon cancer, 3D laparoscopic CME has become a safe and feasible surgical option.

In summary, 3D laparoscopic CME shows significant advantages in the treatment of right-sided colon cancer. Compared to traditional 2D laparoscopic technology, 3D laparoscopy offers a clearer, more three-dimensional surgical view, making surgical operations more precise and safe. Additionally, 3D laparoscopy can shorten surgery times, reduce intraoperative blood loss, and promote postoperative recovery. Therefore, for surgeons with the appropriate skills and experience, 3D laparoscopic CME is a worthwhile surgical technique to promote. However, it should also be recognized that 3D laparoscopy still has certain challenges and issues, such as how to further improve the clarity and stereoscopic perception of 3D imaging and how to reduce patient discomfort. These areas require further research and exploration. Furthermore, with the continuous advancement and development of medical technology, more advanced and efficient surgical techniques and methods may emerge in the future. Therefore, continuous learning and exploration of new knowledge and technical methods are necessary to provide patients with more scientific and rational treatment options.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Chen Y, Cheng X, Tang G, 2023, Analysis of the Effects of Different Approaches for Laparoscopic Complete Mesocolic Excision in the Treatment of Right-sided Colon Cancer. Medical Theory and Practice, 36(20): 3483–3485.

[2] Qin M, Li J, 2023, Clinical Effects of Laparoscopic Complete Mesocolic Excision Using the Left Border of the Mesenteric Artery as the Medial Boundary in the Treatment of Right-Sided Colon Cancer. Clinical Medical Engineering, 30(7): 895–896.

[3] Du X, Liu J, Zhou W, et al., 2021, Clinical Effects of Laparoscopic Complete Mesocolic Excision Combined with Mesenteric Vessel Root Ligation in the Treatment of Right-Sided Colon Cancer. Journal of Clinical and Experimental Medicine, 20(23): 2544–2548.

[4] Lan N, Tang J, Wang W, et al., 2021, Clinical Effects of Laparoscopic Right Hemicolectomy Guided by the Superior Mesenteric Artery in the Treatment of Right-Sided Colon Cancer. Clinical Medicine Research and Practice, 6(15): 17–19.

[5] Lin W, Cui J, Huang Q, et al., 2020, Observation of the Efficacy of Laparoscopic D3 Resection and Complete Mesocolic

Excision in the Treatment of Right-Sided Colon Cancer. Health Medicine Research and Practice, 17(2): 64–68.

[6] Tian Q, 2020, Clinical Effects of Laparoscopic Complete Mesocolic Excision in the Treatment of Right-sided Colon Cancer. Henan Medical Research, 29(2): 259–260.

[7] Zhang J, Tian J, Ji E, et al., 2019, Comparative Study on the Application of 3D and 2D Laparoscopy in Complete Mesocolic Excision for Right-sided Colon Cancer. Anhui Medical Journal, 40(11): 1256–1258.

[8] Jin D, Chen G, 2019, Observation of the Efficacy of Laparoscopic Complete Mesocolic Excision in the Treatment of Right-sided Colon Cancer. Zhejiang Medicine, 41(12): 1312–1315.

[9] Zhang F, 2019, Comparative Study of 3D and 2D Laparoscopy in Complete Mesocolic Excision for Right-sided Colon Cancer, thesis, China Medical University.

[10] Li Y, Yang B, 2019, Effects of 3D Laparoscopic Complete Mesocolic Excision on Postoperative Changes in MicroRNA-101 and CD4~+ Levels and Local Recurrence Rates in Patients with Right-Sided Colon Cancer. Chinese Journal of Endoscopy, 25(4): 24–31.