Int J Clin Exp Med 2018;11(11):11772-11780
www.ijcem.com /ISSN:1940-5901/IJCEM0079677

Original Article

Value of laparoscopic and fast-track surgery in the application of sigmoid colon cancer resection

Haixing Fang[1], Shijie Shao[1], Qunfeng Xia[1], Jing He[1], Chunliang Wang[1], Jianfeng Cai[1], Xiujun Cai[2]

[1]Department of Hepatobiliary Surgery, The First People's Hospital of Fuyang District of Hangzhou, Hangzhou, Zhejiang, China; [2]Department of General Surgery, Shaoyifu Hospital, Hangzhou, Zhejiang, China

Received May 15, 2018; Accepted June 15, 2018; Epub November 15, 2018; Published November 30, 2018

Abstract: Objective: The aim of this study was to evaluate the value of laparoscopic and fast-track surgery (FTS) in the application of sigmoid colon cancer resection. Methods: Patients with sigmoid colon cancer (n=582) were selected as subjects for retrospective analysis. They were divided into experimental groups A (laparoscopic surgery combined with FTS; 249 cases), B (laparoscopic surgery alone; 174 cases), and C (traditional laparotomy alone; 159 cases). The three groups were compared in terms of patient operation time, volume of intraoperative blood loss, length of hospital stay, postoperative exhaust time, postoperative defecation time, complications, nursing satisfaction, and scoring of gastrointestinal recovery. Results: Operation time and volume of intraoperative blood loss in group C were significantly greater than those in groups A and B (P<0.05). Length of hospital stay, postoperative exhaust time, and defecation time were the shortest (P<0.05) in group A, followed by group B. Length of hospital stay, postoperative exhaust time, and defecation time were the longest in group C (P<0.05). Complications were fewer and nursing satisfaction was better in group A than those in the other two groups (P<0.05). Differences in gastrointestinal function recovery scores among the three groups were statistically significant (P<0.05). Group A scored the highest (P<0.05), followed by group B (P<0.05), with group C scoring the lowest (P<0.05). Conclusion: Use of laparoscopy combined with FTS can effectively reduce incidence of injury and complications in patients undergoing sigmoid colon cancer resection, significantly improving patient prognosis.

Keywords: Laparoscopy, concept of fast-track surgery, sigmoid colon cancer, application value

Introduction

Colon cancer is an extremely common malignant tumor of the digestive tract. It mostly arises at the junction of the rectum and sigmoid colon. Sigmoid colon cancer is the most common type of colon cancer, accounting for the third highest incidence among all gastrointestinal cancers [1]. According to statistics reported by Bertelsen et al. [2], in 2015, there were approximately 4.2 million new cases of sigmoid colon cancer, worldwide, with 2 out of every 3 patients being male. With the development of society, living standards have progressed and incidence of colon cancer has increased.

Kim et al. [3] demonstrated that incidence of colon cancer has risen in recent years. Colon cancer is mostly found in middle-aged and elderly people, but increasingly more studies [4-6] have demonstrated that incidence of colon cancer is showing a trend toward youthfulness. Current incidence of colon cancer in patients younger than 30 years old is about 12.85%. At the beginning of the last century, due to incomplete development of medical technology and information, many patients with colon cancer were unable to receive adequate diagnosis and treatment, leading to a mortality rate of up to 60% [7]. With continuous advancements in research, clinical breakthroughs have been made regarding diagnosis and treatment of colon cancer. According to Bae et al. [8], since 2012, the effective treatment rate of colon cancer has basically stabilized at 80%. Prognosis of mortality has also been greatly reduced. Currently, primary goals can be achieved by radical resection. Tumor resection is a surgery with a large trauma area. Patients spend a large amount of medical resources, during and after surgery, with high risk of postoperative infection [9]. This is a major issue in the treatment of colon cancer.

Clinical research and discussion have been continuously conducted to identify an effective resolution for these problems. In recent years, improvement and popularization of laparoscopy have played important roles in improving resection of various types of cancer diseases [10]. Laparoscopic surgery is characterized by less bleeding, less pain, and quicker recovery, which can effectively relieve patient infections after resection. It has been increasingly studied in combination with fast-track surgery (FTS) for application in all types of surgical patients [11-13]. These studies conjecture that laparoscopic surgery combined wzith FTS in sigmoid colon resection surgery will have high application value. Currently, there is little-related research. To provide effective references and guidance for future clinical treatment, this study retrospectively analyzed patients with sigmoid colon cancer undergoing laparoscopic surgery and FTS.

Materials and methods

General information

Five hundred and eighty-two patients with sigmoid colon cancer, from The First People's Hospital of Fuyang District of Hangzhou, were selected as subjects for retrospective analysis. Patients were 30-60 years old, with a mean age of 42.58±9.74 years. According to different surgical methods, they were divided into experimental groups A (laparoscopic surgery combined with FTS; 249 cases), B (laparoscopic surgery alone; 174 cases), and C (traditional laparotomy alone; 159 cases).

Inclusion and exclusion criteria

Inclusion criteria were: patients exhibited symptoms highly consistent with clinical symptoms of sigmoid colon cancer, were diagnosed with sigmoid colon cancer based on pathological biopsy, underwent surgical treatment after diagnosis, had complete case data, and were willing to cooperate with hospital staff. Exclusion criteria were: surgical intolerance, other tumor diseases, other cardiovascular and cerebrovascular diseases, intestinal perforation and infarction, mental illness, previous history of open surgery, history of chemotherapy, multiple tumor metastases, tumor lesions that could not be completely isolated during surgery, and transfer to another hospital. All recruited patients provided informed consent.

Method

All surgeries were performed by a team of senior experts strictly following the 2010 colon cancer operation manual [14]. Patients in experimental group C were required to take a liquid food diet 1 day before surgery. A sodium phosphate solution was orally administered and cleansing enema was performed before surgery and on the morning of surgery. A stomach tube was usually placed during the surgery. After general anesthesia, surgery was performed. Morphine dosages were not limited during surgery and the drainage tube was routinely placed. Wounds were sutured after complete resection of lesions using an automatic controlled intravenous analgesia pump (patient-controlled analgesia, PCA) and opioid analgesics were given for postoperative analgesia. The stomach tube was removed after patients recovered from exhaustion and liquid and semi-liquid food-based diets were administered. The urinary catheter was retained until urination was recovered and the drainage tube was removed after 6-7 days. The surgery method of experimental group B was basically the same as that of experimental group C. Several minimally invasive incisions were created on the abdomen at the time of surgery. Major blood vessels were separated using laparoscopy. The colon was dissected according to the anatomical level and all diseased intestine segments were removed. Lymph node clearance was performed nearby. After removal was completed, the abdominal cavity was placed for draining and the wound was sutured. The surgery method of experimental group A involved the oral intake of sodium phosphate solution for bowel preparation 1 day before surgery. No water or food was allowed 5 hours before surgery and oral intake of 1000 mL of 10% glucose was administered. No gastric tubes were inserted during surgery. Anesthesia did not involve anxiolytic drugs. Thoracic epidural anesthesia or systemic anesthesia was administered, limiting the amount of morphine and fluid used. The surgical method was the same as that of experimental group B. No drainage tubes were placed during surgery. Post-

Table 1. Comparison of clinical data of three groups of patients [n (%)]

	Experiment A group (n=249)	Experiment B group (n=174)	Experiment C group (n=159)	F	P
Age	41.86±8.73	40.96±10.57	41.36±9.85	0.46	0.63
Body weight (KG)	75.84±10.62	73.44±12.57	74.38±12.49	2.23	0.11
Disease course (d)	24.68±13.62	25.94±12.44	24.37±14.37	0.66	0.52
RBC ($\times 10^{12}$/L)	1.84±1.04	1.72±1.34	1.62±1.08	1.84	0.16
WBC ($\times 10^{9}$/L)	2.86±1.48	3.04±2.33	2.74±1.69	1.15	0.32
PLT ($\times 10^{9}$/L)	86.17±29.39	91.52±30.54	88.93±31.58	1.61	0.20
Gender				0.55	0.62
Male	168 (67.47)	108 (62.07)	108 (67.92)		
Female	81 (32.53)	66 (37.93)	51 (32.08)		
Pathological stage				9.45	0.05
I~II	115 (46.18)	79 (45.40)	74 (46.54)		
III~IV	134 (53.82)	95 (54.60)	85 (53.46)		

operative epidural analgesia was continued for 48 hours after surgery. Patients were orally administered anti-inflammatory and analgesic drugs. Catheters were indwelled for 24 hours after surgery and body cavity drainage tubes were removed 48-72 hours after surgery. Tangerine peels were administered to mix protein concentrates with water within 24 hours after surgery. Some simple physical activity, with the assistance of a nurse, was conducted 1 day after surgery. The amount of exercise was gradually increased to help patients get out of bed as soon as possible.

Observation indicators

Observation indicators were based on clinical data (age, course of illness, and pathological stage). Intraoperative indicators, including patient operative time (from the beginning to the end of surgery) and volume of intraoperative blood loss. Postoperative index included length of hospital stay (from time of admission to discharge). Hospital discharge standards strictly followed 2012 guidelines for colon cancer rehabilitation [15]: oral semiliquid diets could be consumed, intravenous fluids did not need to be added, free exercise could be performed without assistance, and oral analgesic drugs could be administered to effectively control pain. Postoperative index also included postoperative exhaust time (first exhaust total time after surgery), postoperative defecation time (first defecation total time after surgery), incidence of complications (such as incision bleeding, pulmonary infections, urinary tract infections, and venous thrombosis of the lower extremities), and satisfaction of nursing (using an anonymous scoring system with higher scores indicating greater satisfaction). Patients completed a half-year follow up survey via telephone to check the prognosis of gastrointestinal function recovery. Three senior physicians in the Department of Digestive Surgery evaluated anonymous recovery on an excellent-good-fair-poor-grade scale. They recorded overall gastrointestinal recovery of patients (scores were excellent and good).

Statistical method

Data were analyzed and processed using SPSS 22.0 statistical software (Asia Analytics, formerly SPSS China). Measurement data, such as patient age, patient operating time, and intraoperative blood loss, are expressed in terms of mean ± standard deviation. Comparison of variance analysis was used to compare multiple groups. Pairs of groups were compared using t-test. Count data, such as patient gender, nursing satisfaction, and complications, are expressed in the form of rates. Chi-squared test was used for comparison between groups. $P<0.05$ was considered statistically significant.

Results

Patient clinical data

To demonstrate that experimental results were effective and reliable, age, weight, course of disease, gender, pathological stage, and blood counts were compared among the three groups of patients. There were no significant differences between the three groups ($P>0.05$), proving that the three groups of patients were comparable (**Table 1**).

Intraoperative indicators for patients

Operation times in experimental groups A, B, and C were 128.47±11.57 minutes, 125.47±

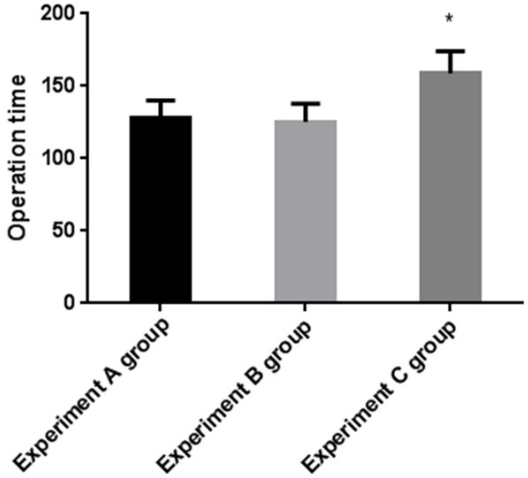

Figure 1. Operating times for the three groups. *Represents comparison with the experimental time of experimental group A, P<0.05. There were no significant differences in operation times between group A and group B (P>0.05); Duration of operation in group C was significantly longer than that of group A and B.

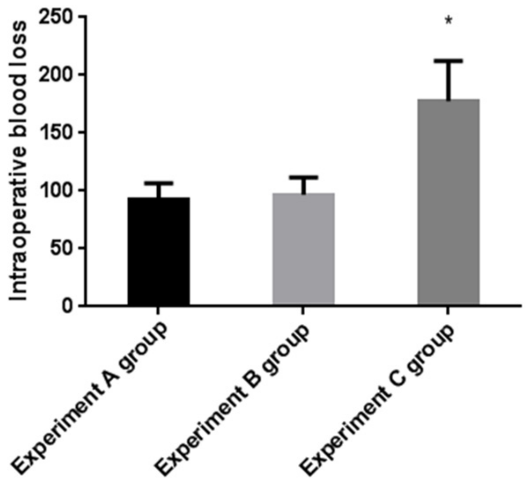

Figure 2. Amount of bleeding in the three groups of patients. *Represents intraoperative blood loss compared with the experimental group A, P<0.05. There were no significant differences in intraoperative blood loss between group A and group B (P>0.050). Intraoperative blood loss was significantly more in group C than in group A and B.

12.36 minutes, and 158.74±15.36 minutes, respectively. Differences in operation times between the three groups were statistically significant (P<0.05). There were no significant differences in operation times between experimental groups A and B (P>0.05). Operation times in experimental group C were significantly longer than those in experimental groups A and B (P<0.05) (**Figure 1**). Volumes of intraoperative blood loss in groups A, B, and C were 92.86±13.77 mL, 96.73±14.85 mL, and 177.52±34.96 mL, respectively. Differences in volumes of intraoperative blood loss were statistically significant between the three groups (P<0.05). There were no significant differences in volumes of blood loss between experimental groups A and B (P>0.05). Volumes of intraoperative blood loss were significantly greater in experimental group C than those in experimental groups A and B (P<0.05) (**Figure 2**).

Postoperative indicators for patients

Lengths of stay in experimental groups A, B, and C were 6.82±1.63 days, 10.57±2.78 days, and 14.87±3.67 days, respectively. Differences in length of hospital stay between the three groups were statistically significant (P<0.05). Lengths of hospital stay in experimental group C were the longest, followed by experimental group B. Patients in experimental group A had the shortest lengths of hospital stay (all P<0.05) (**Figure 3**). Postoperative exhaust times in experimental groups A, B, and C were 41.74±8.75 hours, 56.84±10.27 hours, and 86.77±13.34 hours, respectively. There were statistically significant differences in postoperative exhaust time (P<0.05) between the three groups. Postoperative exhaust times in experimental group C were the longest, followed by experimental group B. Times were the shortest in experimental group A (all P<0.05) (**Figure 4**). Postoperative defecation times in experimental groups A, B, and C were 3.27±1.26 days, 4.53±1.17 days, and 5.46±1.07 days, respectively. Differences in defecation times were statistically significant between the three groups (P<0.05). Defecation times in experimental group C were the longest, followed by experimental group B. Times were the shortest in experimental group A (all P<0.05) (**Figure 5**). Nursing satisfaction scores in experimental groups A, B, and C were 92.37±4.82 points, 79.86±8.04 points, and 63.59±8.24 points, respectively. Differences in nursing satisfaction scores were statistically significant between the three groups (P<0.05). Nursing satisfaction scores in experimental group C were the lowest, followed by experimental group B. Scores were the highest in experimental group A (all P<0.05) (**Figure 6**). The incidence of complications (including one and more than one complications) in experimental groups A, B, and C

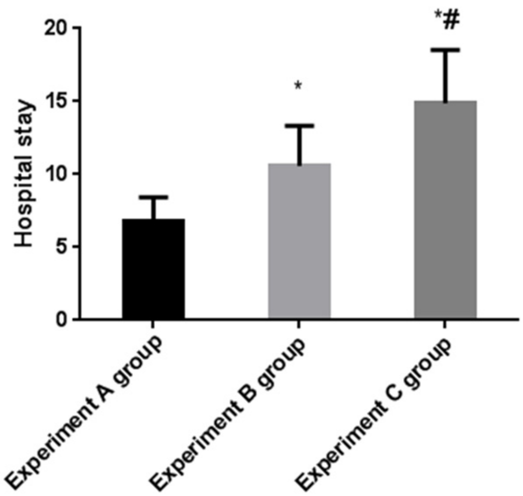

Figure 3. Time of hospitalization for the three groups of patients. *Represents hospitalization time compared with experimental group A, P<0.05. #represents hospitalization time compared with experimental group B, P<0.05. Experimental group C had the longest hospital stay, followed by the experimental group B, and experimental group A had the shortest hospital stay.

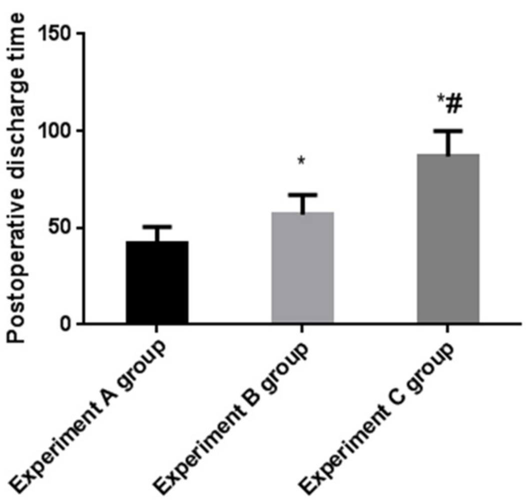

Figure 4. Postoperative venting times for the three groups of patients. *Represents postoperative ventilatory time compared with experimental group A, P<0.05. #Represents postoperative ventilatory time compared with experimental group B, P<0.05. Among them, group C had the longest postoperative exhalation time, followed by experiment group B, and experiment group A had the shortest postoperative exhalation time.

was 1.61%, 11.49%, and 37.11%, respectively. There was statistically significant differences in incidence of complications between the three groups (P<0.05). The incidence of complications was highest in experimental group C

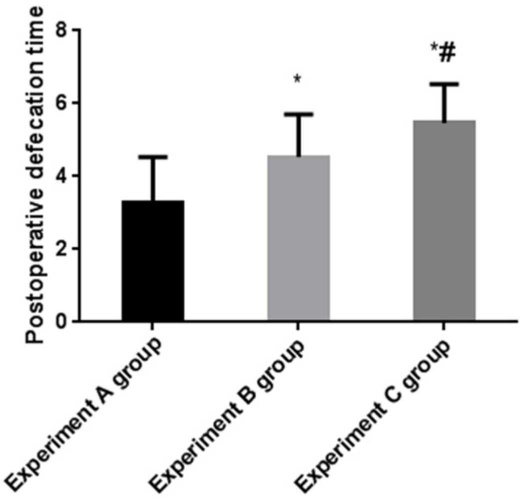

Figure 5. Postoperative defecation times in three groups of patients. *Represents postoperative defecation time compared with experimental group A, P<0.05. #Represents postoperative defecation times compared with experimental group B, P<0.05. Experimental group C had the longest postoperative defecation time, followed by experimental group B. Experimental group A had the shortest postoperative defecation times.

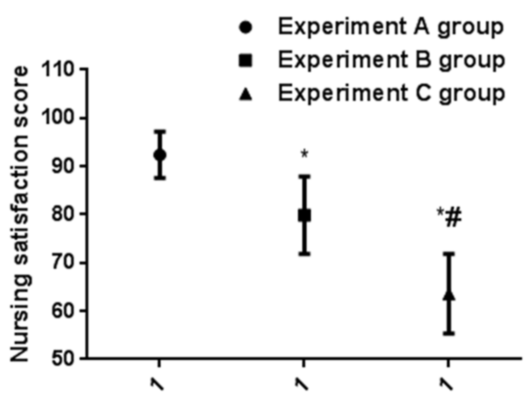

Figure 6. Three groups of patient care satisfaction scores. *Represents a comparison with experimental A group's nursing satisfaction score, P<0.05. #Represents the score of satisfaction with the experimental group B, P<0.05. Experimental group C had the lowest satisfaction rate of care, followed by experimental group B, and experimental group A had the highest satisfaction rate.

(P<0.05), followed by experimental group B (P<0.05). The incidence was the lowest in experimental group A (P<0.05) (**Table 2**).

Prognostic indicators for patients

Of the 582 patients with sigmoid colon cancer, 580 patients were successfully followed up. The success rate of follow up was 99.66%. Of

Table 2. Comparison of complications in three groups of patients [n (%)]

	Experiment A group (n=249)	Experiment B group (n=174)	Experiment C group (n=159)	F	P
Incision bleeding	1 (0.40)	2 (1.15)	12 (7.55)	0.94	0.06
lung infection	2 (0.80)	10 (5.75)	19 (11.95)	0.93	0.07
Nausea and vomiting	5 (2.01)	12 (6.90)	26 (16.35)	0.93	0.08
Intestinal obstruction	0 (0.00)	2 (2.30)	14 (8.81)	0.93	0.07
Urinary system infection	0 (0.00)	1 (0.57)	9 (5.66)	0.94	0.06
Incidence of complications (%)	1.61	11.49*	37.11*,#	8.64	0.02

Note: *Represents complication rate compared with experimental group A, P<0.05. #Represents incidence of complications compared with experimental group B, P<0.05.

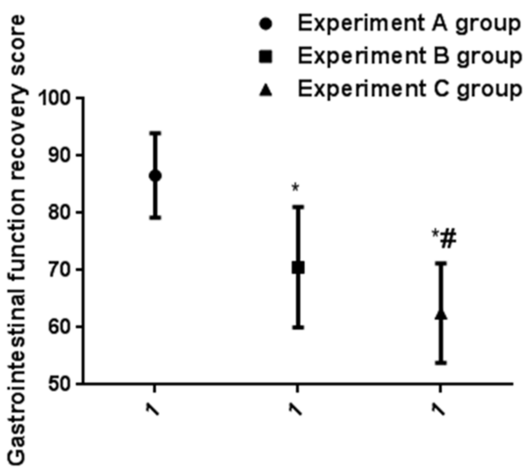

Figure 7. Gastrointestinal function recovery scores in three groups of patients. *Representative and experimental group A gastrointestinal function recovery score comparison, P<0.05. #Represents gastrointestinal function recovery scores compared with experimental group B, P<0.05. Experimental A group had the highest scores, followed by experimental group B, and experimental group C scored the lowest.

these, 1 in experimental group A and 1 in experimental group C were lost to follow up. Recovery scores of gastrointestinal function in experimental groups A, B, and C were 86.57±7.37 points, 70.54±10.53 points, and 62.53±8.69 points, respectively. Differences in gastrointestinal function recovery scores between the three groups were statistically significant (P<0.05). Scores in experimental group A were the highest, followed by experimental group B. Scores were lowest in experimental group C (all P<0.05) (**Figure 7**).

Discussion

Sigmoid colon cancer is a common malignancy, mostly found in middle-aged and elderly people. As human body function weakens with age, patient surgical tolerance naturally decreases. Natural resuscitation capabilities are weakened after patients undergo a series of post-traumatic surgeries, including surgical resection and lymphatic dissection. This is one of the reasons contributing to differences in patient prognosis [16, 17]. With recent improvements in laparoscopic techniques, they have been widely used in clinical surgery for the removal of various types of tumors [18]. Laparoscopic invasive surgery is characterized by minimal trauma and rapid recovery. It is also very effective in the investigation of subtle tumor lesions. At present, there are many related studies [19-21] reporting that clinical and prognostic effects of laparoscopic surgery for tumor diseases are significantly better than those of traditional open surgery. Laparoscopy is the first choice for tumor resection. For some obstinate tumors, such as sigmoid colon cancer, high local recurrence and metastatic rates after surgery remain barriers to overcome in clinical practice. FTS was first proposed by Danish abdominal surgeons Kehlet and Wilemore. They mentioned that multiple pathophysiological adjustments before, during, and after abdominal surgery should be carried out to reduce risk of stress and infection caused by surgery [22]. With continuous progress in research, FTS has been demonstrated to have extremely high application value in all types of abdominal surgery. However, there are few related studies on sigmoid colon cancer. Therefore, through research and analysis, laparoscopic surgery combined with FTS may maximize the prognosis of patients with sigmoid colon cancer and provide scientific reference and guidance for clinical treatment of sigmoid colon cancer.

Results of this present study demonstrated that laparoscopic surgery combined with FTS (experimental group A) was significantly superior to conventional large-open surgery (experimental group C) in terms of intraoperative and postoperative indicators. Compared with laparoscopic surgery alone (experimental group B), there were no significant differences in intraoperative indicators, suggesting that laparoscopic surgery can reduce the degree of body damage in patients with sigmoid colon cancer. Compared with traditional open surgery, it has higher application value. Combined with application of the FTS model, it can effectively improve prognosis and is the best choice for treatment of sigmoid colon cancer among the three methods. Laparoscopic surgery, using the latest technology, can achieve a more precise surgical incision, with less severe surgical trauma, better internal environment stability, and shorter postoperative recovery times. It can not only greatly increase the visual field of small lesions during surgery and enhance the integrity of lesion resection and lymphatic dissection, but also ensure the stability of patient internal environments through a smaller traumatic incision, reduce stress response caused by surgery, and minimize incidence of postoperative complications and risk of infection [23]. This study also compared incidence of postoperative complications among the three groups of patients. However, laparoscopic surgery requires that surgeons have higher professional quality knowledge to improve success rates of surgery. Application of FTS is based on laparoscopic surgery and requires a series of physiological arrangements before surgery to reduce patient insulin resistance and decomposition of metabolic capacity. These include strict intraoperative control and adjustment of patient anesthesia and fluid supplements to reduce unforeseen accidents during surgery and postoperative assistance enabling patients to undergo timely rehabilitation training, promoting healing of muscles and incisions, and improving the body's immune metabolism [24]. In the process of patient admission, FTS requires nurses to pay close attention to patient vital signs and increase the time of communication with patients [25]. This not only allows patients to be more fully prepared during surgery but also improves patient psychological states, promoting prognosis. Intake of an appropriate diet as soon as possible after surgery not only plays a protective role in the intestinal mucosa but can also inhibit patient intestinal flora shift phenomenon, further promoting the recovery of patients. In this present study, patients with intestinal obstruction in experimental group A demonstrated this fact. Patient physical activity after surgery can also greatly improve occurrence of venous thrombosis in the lower extremities and reduce risk of pulmonary infection. Rapid recovery of body function is a key factor determining prognosis.

This study compared physiological parameters of patients with sigmoid colon cancer undergoing laparoscopic surgery combined with FTS, laparoscopic surgery alone, or traditional large open laparotomy. The aim of this study was to explore the application value of laparoscopic surgery combined with FTS for sigmoid colon cancer. There are limitations to this study. There was a relatively limited number of study subjects with a small age span. The present researchers will conduct a long-term follow up survey for this study's subjects and continue to improve and perfect experiments in the future to achieve the best experimental results.

In summary, the use of laparoscopy combined with FTS can effectively reduce incidence of injury and complications in patients undergoing sigmoid colon resection. It can greatly improve the prognosis of patients and is worthy of promotion in clinical practice.

Acknowledgements

Provincial Health Planning Commission Project (2017KY566).

Disclosure of conflict of interest

None.

Address correspondence to: Haixing Fang, Department of Hepatobiliary Surgery, The First People's Hospital of Fuyang District of Hangzhou City, No. 429, Beihuan Road, Fuchun Street, Fuyang District, Hangzhou 311400, Zhejiang, China. Tel: +86-136-83189288; E-mail: fanghaixingg@163.com

References

[1] Kim CW, Cho MS, Baek SJ, Hur H, Min BS, Kang J, Baik SH, Lee KY and Kim NK. Oncologic outcomes of single-incision versus conventional laparoscopic anterior resection for

sigmoid colon cancer: a propensity-score matching analysis. Ann Surg Oncol 2015; 22: 924-930.

[2] Bertelsen CA, Neuenschwander AU, Jansen JE, Wilhelmsen M, Kirkegaard-Klitbo A, Tenma JR, Bols B, Ingeholm P, Rasmussen LA and Jepsen LV. Disease-free survival after complete mesocolic excision compared with conventional colon cancer surgery: a retrospective, population-based study. Lancet Oncol 2015; 16: 161-168.

[3] Kim CW, Kim WR, Kim HY, Kang J, Hur H, Min BS, Baik SH, Lee KY and Kim NK. Learning curve for single-incision laparoscopic anterior resection for sigmoid colon cancer. J Am Coll Surg 2015; 221: 397-403.

[4] Sinicrope FA, Shi Q, Smyrk TC, Thibodeau SN, Dienstmann R, Guinney J, Bot BM, Tejpar S, Delorenzi M and Goldberg RM. Molecular markers identify subtypes of stage III colon cancer associated with patient outcomes. Gastroenterology 2015; 148: 88-99.

[5] Tejpar S, Stintzing S, Ciardiello F, Tabernero J, Van Cutsem E, Beier F, Esser R, Lenz HJ and Heinemann V. Prognostic and predictive relevance of primary tumor location in patients with RAS wild-type metastatic colorectal cancer: retrospective analyses of the CRYSTAL and FIRE-3 trials. JAMA Oncol 2017; 3: 194-201.

[6] Kogita A, Yoshioka Y, Sakai K, Togashi Y, Sogabe S, Nakai T, Okuno K and Nishio K. Inter- and intra-tumor profiling of multi-regional colon cancer and metastasis. Biochem Biophys Res Commun 2015; 458: 52-56.

[7] Tamas K, Walenkamp A, De Vries E, Van Vugt M, Beets-Tan R, Van Etten B, de Groot D and Hospers G. Rectal and colon cancer: not just a different anatomic site. Cancer Treat Rev 2015; 41: 671-679.

[8] Bae SU, Jeong WK and Baek SK. Robotic anterior resection for sigmoid colon cancer using reduced port access. Dis Colon Rectum 2016; 59: 245-246.

[9] Loupakis F, Yang D, Yau L, Feng S, Cremolini C, Zhang W, Maus MK, Antoniotti C, Langer C and Scherer SJ. Primary tumor location as a prognostic factor in metastatic colorectal cancer. J Natl Cancer Inst 2015; 107.

[10] Fernández-Hevia M, Delgado S, Castells A, Tasende M, Momblan D, del Gobbo GD, DeLacy B, Balust J and Lacy AM. Transanal total mesorectal excision in rectal cancer: short-term outcomes in comparison with laparoscopic surgery. Ann Surg 2015; 261: 221-227.

[11] Chen WK, Ren L, Wei Y, Zhu DX, Miao CH and Xu JM. General anesthesia combined with epidural anesthesia ameliorates the effect of fast-track surgery by mitigating immunosuppression and facilitating intestinal functional recovery in colon cancer patients. Int J Colorectal Dis 2015; 30: 475-481.

[12] Chen S, Zou Z, Chen F, Huang Z and Li G. A meta-analysis of fast track surgery for patients with gastric cancer undergoing gastrectomy. Ann R Coll Surg Engl 2015; 97: 3-10.

[13] Bu J, Li N, Huang X, He S, Wen J and Wu X. Feasibility of fast-track surgery in elderly patients with gastric cancer. J Gastrointest Surg 2015; 19: 1391-1398.

[14] West NP, Sutton KM, Ingeholm P, Hagemann-Madsen RH, Hohenberger W and Quirke P. Improving the quality of colon cancer surgery through a surgical education program. Dis Colon Rectum 2010; 53: 1594-1603.

[15] Alfano CM, Ganz PA, Rowland JH and Hahn EE. Cancer survivorship and cancer rehabilitation: revitalizing the link. J Clin Oncol 2012; 30: 904-906.

[16] Bakker N, Cakir H, Doodeman H and Houdijk A. Eight years of experience with enhanced recovery after surgery in patients with colon cancer: impact of measures to improve adherence. Surgery 2015; 157: 1130-1136.

[17] Siani L and Pulica C. Laparoscopic complete mesocolic excision with central vascular ligation in right colon cancer: long-term oncologic outcome between mesocolic and non-mesocolic planes of surgery. Scand J Surg 2015; 104: 219-226.

[18] Spanjersberg W, Van Sambeeck J, Bremers A, Rosman C and van Laarhoven C. Systematic review and meta-analysis for laparoscopic versus open colon surgery with or without an ERAS programme. Surg Endosc 2015; 29: 3443-3453.

[19] Hiki N, Nunobe S, Matsuda T, Hirasawa T, Yamamoto Y and Yamaguchi T. Laparoscopic endoscopic cooperative surgery. Dig Endosc 2015; 27: 197-204.

[20] Irino T, Nunobe S, Hiki N, Yamamoto Y, Hirasawa T, Ohashi M, Fujisaki J, Sano T and Yamaguchi T. Laparoscopic-endoscopic cooperative surgery for duodenal tumors: a unique procedure that helps ensure the safety of endoscopic submucosal dissection. Endoscopy 2015; 47: 349-351.

[21] Boni L, David G, Mangano A, Dionigi G, Rausei S, Spampatti S, Cassinotti E and Fingerhut A. Clinical applications of indocyanine green (ICG) enhanced fluorescence in laparoscopic surgery. Surg Endosc 2015; 29: 2046-2055.

[22] Shao Z, Jin G, Ji W, Shen L and Hu X. The role of fast-track surgery in pancreaticoduodenectomy: a retrospective cohort study of 635 consecutive resections. Int J Surg 2015; 15: 129-133.

[23] Crawshaw BP, Chien HL, Augestad KM and Delaney CP. Effect of laparoscopic surgery on

health care utilization and costs in patients who undergo colectomy. JAMA Surg 2015; 150: 410-415.

[24] Philp S, Carter J, Pather S, Barnett C, D'abrew N and White K. Patients' satisfaction with fast-track surgery in gynaecological oncology. Eur J Cancer Care (Engl) 2015; 24: 567-573.

[25] Dogan K, Kraaij L, Aarts EO, Koehestanie P, Hammink E, van Laarhoven CJ, Aufenacker TJ, Janssen IM and Berends FJ. Fast-track bariatric surgery improves perioperative care and logistics compared to conventional care. Obes Surg 2015; 25: 28-35.