Observational Study

Medicine

OPEN

Comparing the short-term results of the improved triangular anastomosis technique for complete laparoscopic radical resection of sigmoid colon cancer and laparoscopic-assisted small incision colon reconstruction

A CONSORT study

Wenjie Cheng, BA[a,*]

Abstract

The laparoscopic approaches using the triangular anastomosis technique for sigmoid colon cancer (SCC) are rare. This CONSORT study explored the short-term effects of laparoscopic radical resection of SCC with modified triangular anastomosis technique and laparoscopic-assisted small incision colon cancer reconstruction surgery. From April 2019 to January 2021, a total of 86 patients with SCC who were admitted to Luopu County People's Hospital were selected and received radical resection. Patients were divided into 2 groups using a random number table method: in the control group, patients underwent laparoscopic-assisted small-incision reconstruction surgery, and patients in the observation group underwent complete laparoscopic surgery with modified triangular anastomosis technique. The 2 groups were compared in perioperative related indicators and postoperative complications. After 3 months follow-up, local tumor recurrence and metastasis, abdominal wall puncture and implantation, and death were observed. Compared to the control group, shorter operation time, gastrointestinal reconstruction time, postoperative exhaust time, hospitalization time, and less intraoperative blood loss, and lower probability of complications were observed in the observation group ($P < .05$). However, there was no significant difference in the number of lymph node dissections between the 2 groups ($P > .05$). After 3 months of follow-up, no local tumor recurrence, distant tumor metastasis, abdominal wall puncture implantation, and death were found in the 2 groups of patients. It is indicated that the improved triangular anastomosis technique for complete laparoscopic radical resection of SCC is effective in treatment for SCC.

Abbreviations: ASA = American Society of Anesthesiologists, BMI = body mass index, SCC = sigmoid colon cancer.

Keywords: colon cancer reconstruction surgery, laparoscopy, modified triangular anastomosis technique, sigmoid colon cancer

1. Introduction

Sigmoid colon cancer (SCC) is a common clinical malignant tumor of the digestive tract, which occurs in the colon between the descending colon and the rectum of the human body.[1] The main manifestations of early patients with SCC are abdominal pain, bloating, and indigestion.[2] As the disease progresses, the tumor metastasizes, thus causing a serious threat to the life and health.[3] The incidence of SCC is relatively high, and factors such as heredity, colon disease history, polyps, and other factors can induce its appearance.[4,5] In order to improve the survival rate, patients need to receive diagnosis and treatment as soon as possible.

Radical SCC surgery is the first choice for clinical treatment of patients with SCC.[6] However, in terms of gastrointestinal reconstruction, the commonly used laparoscopic-assisted small incision colon reconstruction surgery has certain limitations. Restriction, when performing cutting and anastomosis operation, the intestinal tube needs to be dragged outside the abdominal cavity, which greatly increases the risk of infection and is not conducive to postoperative recovery.[7] Therefore, it is of great significance to use complete laparoscopic surgery to complete the operation of the digestive tract reconstruction inside the patient's abdominal cavity.[8] The improved triangular anastomosis technique has the advantages of simple operation, less trauma, and high safety, which can be used in complete laparoscopic surgery to simplify the operation and improve the effect of the patient's digestive tract reconstruction.[9] In order to explore the clinical efficacy of complete laparoscopic radical resection of the sigmoid colon with improved triangular anastomosis technique, 86 patients were selected for a comparative test in this study.

The authors have no funding and conflicts of interest to disclose.

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

[a] Department of General Surgery, Luopu County People's Hospital, Xinjiang, China.

**Correspondence: Wenjie Cheng, Department of General Surgery, Luopu County People's Hospital, No. 66 Shuangyong Road, Luopu County, 848000, Hotan Prefecture, Xinjiang, China (e-mail: chengwenjie46@163.com).*

How to cite this article: Cheng W. Comparing the short-term results of the improved triangular anastomosis technique for complete laparoscopic radical resection of sigmoid colon cancer and laparoscopic-assisted small incision colon reconstruction: A CONSORT study. Medicine 2022;101:39(e30660).

Received: 9 March 2022 / Received in final form: 18 August 2022 / Accepted: 19 August 2022

http://dx.doi.org/10.1097/MD.0000000000030660

2. Methods

2.1. General information

From April 2019 to January 2021, a total of 86 patients with SCC who were admitted to Luopu County People's Hospital were enrolled in this study. They were divided into 2 groups: the control group (patients underwent laparoscopic-assisted small-incision reconstruction surgery); the observation group (patients underwent complete laparoscopic surgery with modified triangular anastomosis technique). This study was approved by the Medical Ethics Committee of Luopu County People's Hospital, China.

Inclusion criteria: Patients who were diagnosed with SCC after undergoing colonoscopy[10]; Patients without tumor metastasis; Patients with American Society of Anesthesiologists (ASA) classification of I and II; The attending physician confirmed the patients who needed to undergo laparoscopic radical resection of SCC; Those who have signed the informed consent.

Exclusion criteria: Those with a history of abdominal surgery; Those with severe organ diseases; Those with blood or immune system diseases; Those with a tumor diameter of more than 10 cm measured by computed tomography; Those with relevant contraindications; Those who could not cooperate with the researcher.

2.2. Treatment procedure details

All patients underwent radical resection of SCC and used compound polyethylene glycol electrolyte powder (manufacturer: Shenzhen Wanhe Pharmaceutical Co., Ltd., standard name of Chinese medicine: H20030828, specification: 137.15 g/bag) on 1 day before operation, with warm water for each bag 1000 mL (600–1000 mL for the first time, 250 mL 15 minutes apart), until the watery stool was discharged, and an enema was performed to complete the intestinal preparation. After the patient's tracheal intubation was general anesthesia, they took the supine position, and the surgeon would routinely establish pneumoperitoneum. The pressure was maintained within the range of 12 to 14 mm Hg and a five-hole incision was used. The observation hole was located at the lower edge of the umbilicus, the main operation hole was located at the right lower abdomen, and the auxiliary operation holes were located at the left and right upper abdomen slightly higher than the umbilicus and the left in the lower abdomen. A laparoscope was used to explore the surrounding conditions of the patient's lesions, an ultrasonic knife was used to cut the posterior peritoneum, the sub mesenteric blood vessels were free and cut, the lymph nodes were cleaned, the sigmoid colon was freed, colon and upper rectum was descended, and sling ligation was used according to the tumor location at the end of the intestine.

The control group received laparoscopic-assisted small-incision colon reconstruction surgery using a laparoscope linear cutting and closing device (brand: Chuyi, model: EC60A) by the surgeon. Briefly, the intestine was cut at the distal end of the tumor 5 cm, and the left lower abdomen was operated through the abdomen to make a rectus incision. After inserting a protective sleeve, the tumor and intestinal tube were dragged out of the abdominal cavity, the intestinal tube 5 cm proximal was removed to the tumor, and a circular stapler (manufacturing company: Changzhou Ankang Medical Instruments Co., Ltd., registration number: Su Xizhu Standard 20152020086, model: AKYWQA) was applied. The abutment seat was placed in the proximal colon, the operating rod was placed through the anus, the artificial pneumoperitoneum was reestablished, and the anastomosis was completed with the assistance of a laparoscope.

Patients in the observation group underwent laparoscopic modified triangular anastomosis reconstruction surgery. Briefly, the intestinal tube of patients was cut at 5 cm near and distal to the tumor by a surgeon, and the specimen was collected. And then the intestine was pulled, and the blood supply was observed using the cavity. The mirror linear cutting stapler was used to perform an anastomosis on the intestine, making the suture line in a V shape (as shown in Fig. 1). During the suturing process, the start, midpoint, and end of the opening were all sutured with one stitch to obtain a fixation effect. The front half of the opening was closed (as shown in Fig. 2), and then the back half was closed (as shown in Fig. 3). The reconstruction of the digestive tract was completed with the assistance of endoscopy, and the anastomosis was internally seamed. The nail line should be a curved obtuse triangle, and a small incision was made above the pubic bone to remove the specimen.

2.3. Observation indicators

The perioperative indicators of the 2 groups of patients were compared, including the operation time, digestive tract reconstruction time, intraoperative blood loss, number of lymph node dissections, postoperative exhaust time, and hospital stay. Among them, the operation time referred to the time from the incision of the patient's skin until the suture was completed, and the reconstruction time of the digestive tract referred to the time between the intestine from the incision in the operation and

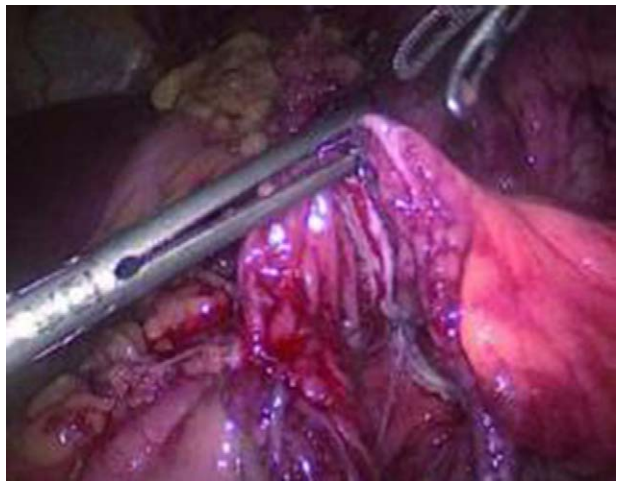

Figure 1. The staple line of the anastomosis is V-shaped.

Figure 2. Closing the front half of the opening.

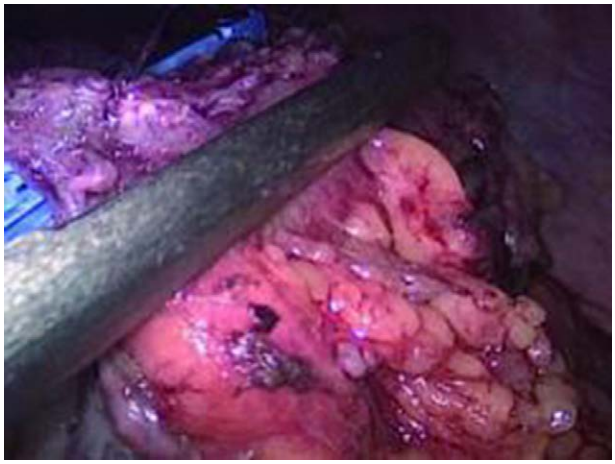

Figure 3. Closing of the second half of the opening.

the intestine on the wall of the intestine. Intraoperative blood loss = intraoperative suction volume + gauze blood volume (each gauze was calculated based on 30 mL blood volume)-surgery Medium rinse volume.

The postoperative complications of the 2 groups of patients were compared, including anastomotic bleeding, anastomotic leakage, lung infection, incision infection, etc.

After 3 months of follow up in the patients, the short-term curative effects of the 2 groups of patients receiving different treatment plans were compared, and the local recurrence of the tumor, the distant metastasis of the tumor, the implantation of the abdominal wall puncture hole, and the death were counted.

2.4. Statistical methods

The data were statistically analyzed using Statistical Product Service Solutions version 19.0 software (IBM, Chicago, IL). The count data was expressed by (%) and the χ^2 test; the measurement data was expressed by mean ± standard deviation, and the t test was used. Logistic regression analysis was used for multiple factors. A P value <.05 indicated that the difference was statistically significant.

3. Results

3.1. General information of patients

General information of patients including age, sex, the body mass index (BMI), tumor size, ASA classification of tumor was compared between the control group and observation group (Table 1). There were 43 patients in the control group and 43 patients in the observation group (P = .7345). The ratio of male to female was 26:17 in the control group and 27:16 in the observation group (P = .4398). The mean age was 62.50 ± 11.50 years in the control group and 62.50 ± 10.50 years in the observation group (P = .5721). BMI was 20.50 ± 3.50 kg/m^2 in the control group and 19.50 ± 3.50 kg/m^2 in the observation group (P = .0972). The largest tumor diameter was 6.18 ± 2.06 cm in the control group and 6.19 ± 2.09 cm in the observation group (P = .1285). According to ASA classification, 29 cases of grade I and 14 cases of grade II were in the control group, 30 cases of grade I and 13 cases of grade II were in the observation (P > .05). Above findings suggest that the 2 groups of patients had no differences in gender, age, BMI, tumor size, ASA grade, and other data (P > .05).

Table 1

Clinical characteristics of patients.

Items	Control group	Observation group	*P* value
Number of cases (n)	43	43	1.0000
Age (yr)	62.50 ± 11.50 (51–74)	62.50 ± 10.50 (52–73)	.5721
Gender (M/F)	26:17	27:16	.4398
BMI (kg/m^2)	20.50 ± 3.50 (17–24)	19.50 ± 3.50 (16–23)	.0972
Tumor size (cm)	6.18 ± 2.06 (4.12–8.24)	6.19 ± 2.09 (4.10–8.28)	.1285
ASA classification			
Grade I	29	30	.0822
Grade II	14	13	.0759
Intestinal obstruction			
Yes	7	8	.1373
No	36	35	.0946
Family history			
Yes	4	3	.2759
No	39	40	.1937

ASA = American Society of Anesthesiologists, BMI = body mass index.

3.2. Comparison of related indicators of the 2 groups of patients during the perioperative period

In the perioperative period, related indicators including operation time, gastrointestinal reconstruction time, postoperative exhaust time, hospitalization time, intraoperative blood loss, the number of lymph node dissected were evaluated between 2 groups of patients (Table 2). Compared to the control group, shorter operation time, gastrointestinal reconstruction time, postoperative exhaust time and hospitalization time, and less intraoperative blood loss were found in the observation group (P < .05). However, there was no significant difference in the number of lymph node dissected between the 2 groups (P > .05).

3.3. Comparison of adverse events between the 2 groups after operation

After operation, adverse events such as anastomotic bleeding, anastomotic leakage, lung infection, incision infection, complication were compared (Table 3). It was indicated that, compared to the control group, a significantly lower probability of complications and incision infection was observed in the observation group (P < .05). Moreover, no significant changes were found in anastomotic bleeding, anastomotic leakage, and lung infection between the 2 groups (P > .05).

3.4. Comparison of the follow-up results of the 2 groups of patients

After 3 months of follow up in the 2 groups of patients, no local tumor recurrence, distant tumor metastasis, abdominal wall puncture implantation, and death were observed in the 2 groups.

4. Discussion

SCC is a malignant tumor with a high incidence in middle-aged and elderly people, which is not easy to be found in the early stage. Most patients have entered the middle and late stages when they see a doctor, so the fatality rate of SCC is high.[11] The clinical treatment is based on surgical operations such as radical resection of SCC, which control the development and deterioration of tumors and delay the progress of cancer.[12] Traditional laparotomy will cause greater trauma to the patient's body, which is not conducive to postoperative recovery, and has more complications and poor prognosis.[13] With the clinical promotion and application of laparoscopic technology, it has gradually replaced laparotomy and become the preferred treatment option for patients with SCC.[14] Laparoscopic radical resection of SCC means that the surgeon makes a small incision on the patient, inserts a

Table 2

Comparison of perioperative indicators between the 2 groups of patients (mean ± SD).

Groups	Operation time (min)	Digestive tract reconstruction time (min)	Intraoperative blood loss (mL)	Number of lymph nodes dissected (Piece)	Postoperative exhaust time (d)	Hospital stay (d)
Control group	184.39 ± 25.22	42.93 ± 8.27	67.43 ± 16.38	16.78 ± 3.47	3.63 ± 1.17	14.34 ± 4.21
Observation group	163.52 ± 23.36	31.85 ± 9.33	51.36 ± 16.35	16.62 ± 3.54	2.84 ± 1.06	10.61 ± 3.52
t	3.981	5.828	4.553	0.212	3.281	4.457
P value	.000	.000	.000	.833	.002	.000

Table 3

Comparison of adverse events postoperation between the 2 groups of patients [n(%)].

Groups	Anastomotic bleeding	Anastomotic leakage	Lung infection	Incision infection	Complication
Control group	2 (4.65%)	1 (2.33%)	3 (6.98%)	2 (4.65%)	8 (18.60%)
Observation group	1 (2.33%)	1 (2.33%)	1 (2.33%)	0 (0.00%)	3 (6.98%)
x^2	0.799	0.000	2.436	4.761	6.053
P value	.371	1.000	.119	.029	.014

laparoscope and medical equipment, and completes operations such as blood vessel disconnection and intestinal release under the field of view provided by the laparoscope, thereby effectively shortening the exposure time of the abdominal cavity and reducing intraoperative trauma of the patient, and the prognostic effect is improved.[15,16] Scholars found that laparoscopic surgery for patients with SCC has a better therapeutic effect. However, due to the limited operation field, the patient's intestinal tube needs to be dragged out of the abdominal cavity and the digestive tract is reconstructed. To a certain extent, the difficulty of the operation and the risk of infection are increased.[17] With the continuous improvement of laparoscopic technology, complete laparoscopic surgery can be promoted and applied in clinical practice. It means that with the assistance of laparoscopy, the surgeon completes all surgical operations including the reconstruction of the digestive tract in the patient. The incision is used to take out the surgical specimen immediately, which greatly reduces the surgical incision, makes the abdominal cavity exposure time shorter, and effectively improves the patient's postoperative recovery speed.[18,19] Triangular anastomosis is a new clinical technique for complete laparoscopic reconstruction of the digestive tract. It refers to the application of a linear cutting stapler to complete the functional end-to-end anastomosis of the remnant stomach and the posterior wall of the duodenum. It is named, and the improved triangular anastomosis technique is a technology developed based on the triangular anastomosis. It has the advantages of low operation difficulty and less trauma, and has gradually become the first choice for complete laparoscopic gastrointestinal reconstruction.[20,21] Compared to traditional laparoscopic-assisted small incisions for gastrointestinal reconstruction, complete laparoscopic surgery with improved triangular anastomosis technology does not need to close the incision and create a new pneumoperitoneum when performing intestinal stump anastomosis, and the circular stapler is used to push the nail. The seat can be directly inserted through the auxiliary incision, which not only saves the cost of establishing a pneumoperitoneum during the operation, but also greatly shortens the operation time. At the same time, the surgeon can look directly at the anastomosis with the assistance of a laparoscope to complete the anastomosis operation. It greatly reduces the difficulty of the operation and helps to avoid the patient's injury during the process, thereby reducing the risk of complications such as anastomotic bleeding, which is in line with the minimally invasive concept in clinical surgical treatment.[22,23] In this study, the short-term effects of laparoscopic radical resection of SCC with modified triangular anastomosis technique and laparoscopic-assisted small incision colon cancer reconstruction surgery were evaluated and found that the triangular anastomosis technique for complete laparoscopic radical resection of SCC is more effective in treatment for SCC than laparoscopic-assisted small incision colon cancer reconstruction surgery.

According to the results of this study, compared to the control group, the observation group had shorter operation time, gastrointestinal reconstruction time, postoperative exhaust time, hospitalization time, and less intraoperative blood loss, and a significantly lower probability of complications ($P < .05$). Through analysis, it can be seen that both groups of patients received the same radical resection of SCC, but when performing gastrointestinal reconstruction operations, the control group used laparoscopic-assisted small incision colon reconstruction surgery, which required the surgeon to perform an incision on the patient to establish air in the process. Thus, the patient's abdominal cavity was exposed to the air, which is very likely to cause infection and the increased incidence of postoperative complications. The observation group adopted the improved triangular anastomosis technique. For complete laparoscopic surgery, the stapler can be inserted through the existing auxiliary incision to complete the relevant operation, which simplifies the operation, and uses the feedback of the laparoscopic to perform anastomosis on the intestines for reducing the difficulty of the operation. Therefore, the operation time and gastrointestinal reconstruction time are shortened, and the intraoperative trauma is less, which is beneficial to the recovery of the gastrointestinal tract. The probability of postoperative complications is also reduced. In terms of the number of intraoperative lymph node dissections and postoperative follow-up data, the 2 treatment options are not quite different, suggesting that the 2 types of surgeries have better therapeutic effects.

The present study had several limitations. First, because the study was only obtained from our hospital. Hence, there was a possibility of selection bias due to the single-hospital study. Second, the number of this study was limited, and a longitudinal study using more samples is required to further support the results of this study. Third, patients may have difficulty judging the severity of comorbidities, so the severity was not evaluated in the present study.

5. Conclusions

In summary, the laparoscopic radical resection of SCC using the improved triangular anastomosis technique has good therapeutic effects than laparoscopic-assisted small-incision colon

reconstruction surgery. Complete laparoscopic surgery using the improved triangular anastomosis technique can effectively reduce the surgical trauma of the patient, shorten the operation time, and reduce the probability of postoperative complications. Furthermore, the patient will recover faster after the operation, the short-term effect is high, and it has a higher clinical effect on the promotion value.

Author contributions

Conceptualization: Wenjie Cheng.
Data curation: Wenjie Cheng.
Formal analysis: Wenjie Cheng.
Investigation: Wenjie Cheng.
Methodology: Wenjie Cheng.
Project administration: Wenjie Cheng.
Resources: Wenjie Cheng.
Writing – original draft: Wenjie Cheng.
Writing – review & editing: Wenjie Cheng.

References

[1] Akyuz M, Topal U, Gok M, et al. Sigmoid colon cancer presenting as complete prolapse. Ann Ital Chir. 2019;8:345–8.
[2] Zeng J, Su G. High ligation of the inferior mesenteric artery during sigmoid colon and rectal cancer surgery increases the risk of anastomotic leakage: a meta-analysis. World J Surg Oncol. 2018;16:157.
[3] D'Souza N, Shaw A, Lord A, et al. Assessment of a staging system for sigmoid colon cancer based on tumor deposits and extramural venous invasion on computed tomography. JAMA Netw Open. 2019;2:e1916987.
[4] Furuichi Y, Kumamoto K, Asano E, et al. Four cases of laparoscopic colectomy for sigmoid colon and rectal cancer with persistent descending mesocolon. Surg Case Rep. 2020;6:255.
[5] Planellas P, Salvador H, Farrés R, et al. A randomized clinical trial comparing the initial vascular approach to the inferior mesenteric vein versus the inferior mesenteric artery in laparoscopic surgery of rectal cancer and sigmoid colon cancer. Surg Endosc. 2019;33:1310–8.
[6] Urbanowicz W, Starzyk J, Sulislawski J. Laparoscopic vaginal reconstruction using a sigmoid colon segment: a preliminary report. J Urol. 2004;171:2632–5.
[7] Miyamoto R, Tadano S, Sano N, et al. The impact of three-dimensional reconstruction on laparoscopic-assisted surgery for right-sided colon cancer. Wideochir Inne Tech Maloinwazyjne. 2017;12:251–6.
[8] Yan D, Yang X, Duan Y, et al. Comparison of laparoscopic complete mesocolic excision and traditional radical operation for colon cancer in the treatment of stage III colon cancer. J BUON. 2020;25:220–6.
[9] Hosoda K, Mieno H, Ema A, et al. Delta-shaped anastomosis vs circular stapler anastomosis after laparoscopic distal gastrectomy with Billroth I reconstruction: a randomized controlled trial. Asian J Endosc Surg. 2020;13:301–10.
[10] Benson AB, Venook AP, Al-Hawary MM, et al. NCCN Guidelines insights: colon cancer, version 2.2018. J Natl Compr Canc Netw. 2018;16:359–69.
[11] Takada M, Okuyama T, Yoshioka R, et al. A case with mesenteric desmoid tumor after laparoscopic resection of stage I sigmoid colon cancer. Surg Case Rep. 2019;5:38.
[12] Kimura J, Lefor AK, Kubota T. Colonic ischemia mimicking obstruction due to sigmoid colon cancer: a case report. Int J Surg Case Rep. 2018;46:38–40.
[13] Katsumoto Y, Itoh N, Maruyama K, et al. Sigmoid colon cancer with a tumor thrombosis in the splenic vein–a case report. Gan To Kagaku Ryoho. 2006;33:1974–6.
[14] Ding Y, Li Z, Gao H, et al. Comparison of efficacy between natural orifice specimen extraction without abdominal incision and conventional laparoscopic surgery in the treatment of sigmoid colon cancer and upper rectal cancer. J BUON. 2019;24:1817–23.
[15] Skelton WP, 4th, Franke AJ, Iqbal A, et al. Comprehensive literature review of randomized clinical trials examining novel treatment advances in patients with colon cancer. J Gastrointest Oncol. 2020;11:790–802.
[16] Watanabe J, Ishibe A, Suwa Y, et al. Indocyanine green fluorescence imaging to reduce the risk of anastomotic leakage in laparoscopic low anterior resection for rectal cancer: a propensity score-matched cohort study. Surg Endosc. 2020;34:202–8.
[17] Gu J, Deng S, Cao Y, et al. Application of endoscopic technique in completely occluded anastomosis with anastomotic separation after radical resection of colon cancer: a case report and literature review. BMC Surg. 2021;21:201.
[18] Moghadamyeghaneh Z, Talus H, Ballantyne G, et al. Short-term outcomes of laparoscopic approach to colonic obstruction for colon cancer. Surg Endosc. 2021;35:2986–96.
[19] Oh RK, Ko HM, Lee JE, et al. Clinical impact of sarcopenia in patients with colon cancer undergoing laparoscopic surgery. Ann Surg Treat Res. 2020;99:153–60.
[20] Bae SU, Jeong WK, Baek SK. Reduced-port laparoscopic complete mesocolic excision and intracorporeal anastomosis for right-sided colon cancer – a video vignette. Colorectal Dis. 2020;22:1768–9.
[21] Olmi S, Oldani A, Cesana G, et al. Laparoscopic one anastomosis gastric bypass versus laparoscopic one anastomosis gastric bypass with braun anastomosis: what's better? J Laparoendosc Adv Surg Tech A. 2019;29:1469–74.
[22] Su H, Jin WS, Wang P, et al. Intra-corporeal delta-shaped anastomosis in laparoscopic right hemicolectomy for right colon cancer: a safe and effective technique. Gastroenterol Rep (Oxf). 2019;7:272–8.
[23] Su H, Jin W, Wang P, et al. Comparing short-time outcomes of three-dimensional and two-dimensional totally laparoscopic surgery for colon cancer using overlapped delta-shaped anastomosis. Onco Targets Ther. 2019;12:669–75.