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Clinical effects of prophylactic transverse colostomy in patients undergoing completely laparoscopic transabdominal approach partial intersphincteric resection

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Abstract

Objective: To investigate the clinical effects of prophylactic transverse colostomy on gastrointestinal function recovery and complications in patients undergoing completely laparoscopic transabdominal approach partial intersphincteric resection (CLAPISR) of low rectal cancer.

Methods: We retrospectively analyzed the data of 74 patients with low rectal cancer who were treated with prophylactic transverse colostomy (Group A, n = 34) or without prophylactic transverse colostomy (Group B, n = 40). Surgery-related indicators, nutritional status indicators, systemic stress response indicators, and complications were compared between the two groups.

Results: On postoperative day 5, the C-reactive protein concentration and white blood cell count were not significantly different between the two groups; however, the serum concentrations of total protein and albumin were higher in Group A than in Group B. Within 26 months postoperatively, the total incidence rate of complications was not significantly different, but the incidence rate of anastomotic leakage was lower in Group A than in Group B.

Conclusion: Prophylactic transverse colostomy based on CLAPISR can lead to faster recovery of gastrointestinal function, better improvement of postoperative nutritional indicators, and

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a lower incidence of anastomotic leakage. These characteristics are conducive to the rapid recovery of patients, making this procedure worthy of clinical application.

Keywords

Prophylactic transverse colostomy, low rectal cancer, partial intersphincteric resection, gastrointestinal function, anastomotic leakage, surgical effect

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Introduction

Colorectal cancer is the third most common cancer worldwide, accounting for the fourth highest number of new cases of cancer and the second highest number of deaths.[1] Rectal cancer is the most common type of colorectal cancer, and the most significant feature of rectal cancer in China is that 60% to 75% of cases are low rectal cancer (LRC); this is a higher proportion than reported in the West.[2] LRC is diagnosed when the lower edge of the tumor is located less than 5 cm from the anal verge. Through the development of total mesorectal excision,[3] neoadjuvant therapy,[4,5] imaging technology,[6] and laparoscopic technology,[7] surgical treatment of LRC has improved the survival rate and sphincter preservation rate. In 1994, Schiessel et al.[8] first reported intersphincteric resection (ISR) for very low rectal tumors. In this procedure, the intersphincteric plane is dissected with removal of the internal sphincter, and bowel continuity is restored by coloanal anastomosis instead of traditional abdominoperineal resection. Many clinical studies have confirmed that laparoscopic or open ISR is safe and feasible while achieving satisfactory radical tumor outcomes.[9,10]

Anastomotic leakage is a severe complication of sphincter-preserving surgery. The incidence of anastomotic leakage after sphincter-preserving surgery reportedly ranges from 3.6% to 25%,[11–13] and the mortality rate associated with anastomotic leakage is as high as 13.9%.[14] The risk of anastomotic leakage increases as the distance from the anastomotic location to the anus decreases.[15] The correlation between prophylactic ostomy and postoperative anastomotic leakage in patients with rectal cancer is still controversial.[16,17] More importantly, there is a lack of research on the clinical value of prophylactic transverse colostomy in completely laparoscopic transabdominal approach partial ISR (CLAPISR).

We evaluated the clinical effects of prophylactic transverse colostomy by investigating the surgery-related indicators, nutritional status indicators, systemic stress response indicators, and incidence of complications in patients with and without prophylactic colostomy undergoing CLAPISR.

Materials and methods

Patients

This retrospective clinical study involved 74 consecutive patients with LRC undergoing CLAPISR at the Department of Gastrointestinal Surgery of the Affiliated Hospital of Chengde Medical University from June 2017 to June 2021. After promoting the application of prophylactic transverse colostomy to CLAPISR in December 2018, we categorized patients who underwent prophylactic transverse colostomy as Group A and those who did not undergo prophylactic transverse colostomy as Group B. At a mean follow-up of 3.94 ± 1.39 months after surgery, patients in Group A underwent stoma closure. These operations were performed by the same team. All patients underwent rectal examination, electronic colonoscopy, anal dynamics testing, and pelvic magnetic resonance imaging before the operation to evaluate the distance from the tumor to the anal margin, tumor size, preoperative anal function, and clinical T stage. After dilatating the anus under intraoperative general anesthesia, we measured the distance from the tumor to the anal margin under direct vision.

Inclusion and exclusion criteria. The inclusion criteria were a $\leq$5-cm distance between the tumor and the anal margin under sigmoidoscopy, age of 18 to 80 years, rectal adenocarcinoma confirmed by pathology, well-differentiated or moderately differentiated tumor confirmed by histological examination, clinical T stage of T1 or T2 (including patients whose tumors were downgraded to T1 or T2 after neoadjuvant chemoradiotherapy), normal anal sphincter function as shown by anal dynamics testing, and resectable cancer without distant metastasis as evaluated by imaging examination. The exclusion criteria were preoperative synchronous cancers; lateral lymph node metastases; invasion of the external sphincter, levator ani, or other adjacent organs; lack of preservation of the left colonic artery; and performance of emergency surgery or palliative resection.

Operative procedures

Establishment of laparoscopic operation platform and abdominal exploration. After successful induction of general anesthesia, the surgeon placed the patient in a modified lithotomy position and routinely disinfected and sheeted the operative area. An approximately 1.2-cm-long arc incision was made on the umbilicus, and the abdominal cavity was entered. A 10-mm trocar (trocar A in Figure 1(a)) was inserted through this incision, a pneumoperitoneum

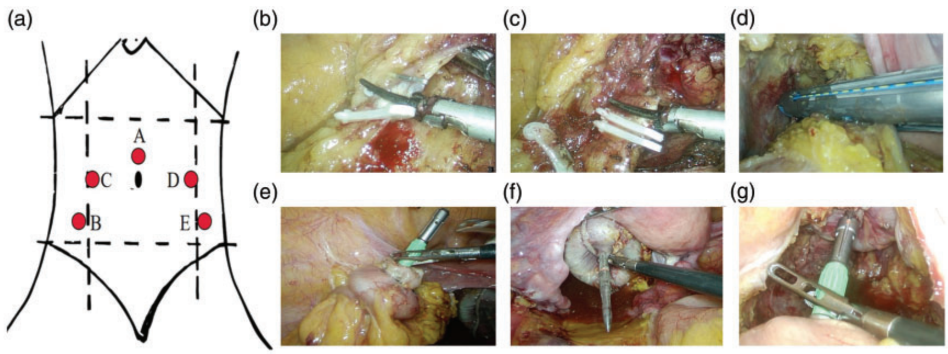

Figure 1. Key surgical steps and tips. (a) Trocar placement for completely laparoscopic transabdominal approach partial intersphincteric resection. Five trocars were inserted as follows: supraumbilical trocar (Trocar A, 10 mm), right anterior superior iliac spine medial 3-cm trocar (Trocar B, 12 mm), right rectus abdominis outer trocar at the umbilical level (Trocar C, 5 mm), left rectus abdominis outer trocar at the umbilical level (Trocar D, 5 mm), and left anterior superior iliac spine medial 3-cm trocar (Trocar E, 5 mm). (b) Ligation of inferior mesenteric artery. (c) Ligation of inferior mesenteric vein. (d) Disconnection and closure of rectum with linear cutting stapler. (e) Circular stapler head. (f) Circular stapler body. (g) Head–body anastomosis using the circular stapler was completed with the aid of surgical instruments.

was established; the pressure was maintained at 12 mmHg. A 30° laparoscope was placed through this trocar to explore the abdominal cavity for any abnormalities. Under laparoscopic monitoring, one 12-mm trocar (trocar B in Figure 1(a)) and three 5-mm trocars (trocars C, D, and E in Figure 1(a)) were then placed, avoiding the inferior abdominal artery.

Dissociation and anatomy of sigmoid colon. The sigmoid colon was pulled to keep its mesangium tense. Starting from the sacral promontory level, an ultrasonic scalpel was used to peel off the sigmoid mesangium and enter Toldt's space behind it. Dissection was continued until reaching Toldt's line of the sigmoid colon. The lymph nodes surrounding the inferior mesenteric artery were removed, and the inferior mesenteric artery (Figure 1b) and inferior mesenteric vein (Figure 1c) were ligated with Hem-o-lok hemostatic clips (Kangji Medical Holdings Ltd., Hangzhou, China). The colon was separated from right to left along with Toldt's space to the left peritoneum. The sigmoid colon and left peritoneal space were opened, and the dissection was continued until reaching the lower edge of the spleen. The proximal branch of the mesentery along the left Toldt's space allowed the descending colon to reach the anus with no tension.

Stripping of rectum. According to the principle of total mesorectal excision, the posterior, lateral, and anterior mesentery of the rectum were sharply separated with an ultrasonic scalpel to the level of the levator ani muscle. During dissociation, close attention was given to protecting the ureter and pelvic autonomic nerve. The posterior adhesion line between the puborectalis muscle and rectal wall was exposed. The intersphincteric space was entered along the dissection plane at the dorsolateral side of the rectum. The anococcygeal ligament was then dissected and transected at the posterior side.[18] The distal bowel wall was mobilized for 3 cm from the lower edge of the tumor to obtain an adequate distal margin of 1 or 2 cm. At this point, the circular dissection of the intersphincteric space was completed.

Resection of rectal tumor and removal of specimen. A digital rectal examination was required to determine the lower edge of the rectal tumor and mark the cutting position of the stapler. A 45-mm linear cutting stapler was used from trocar B to cut at a distance of 2 cm from the lower edge of the tumor (Figure 1(d)). A longitudinal incision of approximately 5 cm was made in the patient's upper abdomen, and a plastic cover was placed to protect the incision. The free sigmoid colon was taken out through the incision, the intestine was cut 15 cm away from the upper part of the tumor, and the tumor specimen was placed into a specimen bag.

End-to-end anastomosis. The head of the circular stapler was placed into the proximal intestine, and a purse-string suture was applied; the stapler head was then put it into the pelvic cavity for use (Figure 1(e)). We re-established pneumoperitoneum. Under laparoscopy, we observed that the distal rectal stump was well closed without active bleeding. After disinfecting the anus with iodophor and expanding the anus, we inserted the body of the circular stapler through the anus (Figure 1(f)). With the aid of surgical instruments, the head–body anastomosis using the circular stapler (i.e., end-to-end anastomosis) was completed (Figure 1(g)). After flushing the abdominal cavity, a pelvic drainage tube was routinely placed, and the rubber tube was placed at the anal canal.

All procedures were performed by the same surgical team and with the same technique. In all patients, the rectum was stripped to the lower end of the spleen, and the left colonic artery was preserved when dissociating the left colonic mesangium. Patients in Group A additionally underwent prophylactic transverse colostomy based on the above operations. Briefly, the operative steps for prophylactic transverse colostomy were as follows. An approximately 4-cm-diameter circular incision was made in the middle of the upper abdomen, and the rectus abdominis was bluntly separated. The abdominal cavity was entered, and the transverse colon, which was intended to be exteriorized, was raised outside the incision. The posterior and anterior rectus abdominis sheaths were fixed with interrupted sutures to the bowel wall of the stoma. The transverse colon was sutured to the external oblique aponeurosis. A 3.5-cm longitudinal incision was made along the transverse colonic band using an electric knife. The incised bowel wall was then sutured directly to the skin. The operator inserted a finger into the proximal and distal ends of the stoma to check for bowel patency.

Clinicopathological characteristics

Clinical baseline data. The following clinical baseline data were analyzed: sex, age, body mass index, preoperative serum carcinoembryonic antigen concentration, preoperative serum carbohydrate antigen 19-9 concentration, American Society of Anesthesiologists score, histological differentiation, tumor size, distance from anal margin, clinical T stage, and neoadjuvant chemoradiotherapy.

Surgery-related data. The following surgery-related data were assessed: operation time, intraoperative blood loss, number of dissected lymph nodes, first postoperative exhaust time, first postoperative defecation time, postoperative time to removal of the abdominal drain, first time out of bed after the operation, postoperative hospital stay, and incidence of complications (anastomotic leakage, anastomotic stricture, and incisional infection). The operation time was obtained from the anesthesia record sheet. The intraoperative blood loss was calculated as the total amount of fluid aspirated during the operation minus the amount of abdominal irrigation fluid. The number of dissected lymph nodes was obtained from the postoperative pathological report.

Nutritional status indicators and systemic stress response indicators. The nutritional status and systemic stress response indicators in Groups A and B were collected before the operation, on the first postoperative day, and on the fifth postoperative day. The nutritional status indicators were the serum concentrations of total protein and albumin. The systemic stress response indicators were the white blood cell (WBC) count and C-reactive protein (CRP) concentration.

Complications. Postoperative anastomotic leakage after rectal surgery was defined as a connection between the intestinal and extraintestinal spaces caused by a defect in the integrity of the colorectal or coloanal anastomosis (including the stapling of the storage pouch).[19] Although no uniform definition of anastomotic stricture exists,[20] we defined it as the inability to traverse the anastomosis with a 12-mm-diameter colonoscope. Incisional infections were diagnosed based on the presence of clear signs of inflammation at the incision margin or purulent drainage from the incision.

Diagnosis and grading of anastomotic leakage

Clinical signs of anastomotic leakage included abdominal pain, abdominal distention, fever, and purulent or fecal discharge from the pelvic drain. All clinically suspicious symptoms of anastomotic leakage were confirmed by digital rectal examination and radiographic examination (e.g., extravasation of endoluminally administered water-soluble contrast enema, a pelvic abscess, or fluid/air bubbles surrounding the anastomosis on computed tomography).[21] The International Study Group of Rectal Cancer recommends division of anastomotic leakage into three grades according to its effect on clinical decision-making[19]: grade A, asymptomatic anastomotic leakage; grade B, obvious clinical symptoms; and grade C, requirement of another surgical intervention.

Statistical analysis

Statistical analyses were performed with GraphPad Prism 8 software (GraphPad Software, San Diego, CA, USA). Quantitative data are presented as mean ± standard deviation and were analyzed by Student's t test. The chi-square test or Fisher's exact test was used for intergroup comparisons of categorical variables. A two-sided P value of <0.05 indicated a statistically significant.

Results

Clinical baseline data of patients with LRC

The patients' preoperative clinical baseline data are shown in Table 1. There was no significant difference between Groups A and B in age, body mass index, carcinoembryonic antigen concentration, carbohydrate antigen 19-9 concentration, tumor size, or distance from the anal margin (Figure 2).

Table 1. Clinical baseline data of patients with low rectal cancer.

	Group A (n = 34)	Group B (n = 40)	*P*
Sex			0.37
Male	16 (47.06)	23 (57.50)	
Female	18 (52.94)	17 (42.50)	
Age, years	61.94 ± 6.38	59.38 ± 7.68	0.126
BMI, kg/m^2	23.02 ± 2.43	23.23 ± 3.23	0.758
Preoperative serum CEA, ng/mL	10.01 ± 20.90	7.01 ± 6.38	0.39
Preoperative serum CA19-9, U/mL	12.23 ± 15.56	9.37 ± 7.54	0.307
Tumor size, cm	3.16 ± 0.79	3.26 ± 1.28	0.691
Distance from anal margin, cm	3.96 ± 1.00	3.98 ± 0.83	0.929
ASA score			0.801
I	7 (20.59)	8 (20.00)	
II	20 (58.82)	26 (65.00)	
III	7 (20.59)	6 (15.00)	
Histological differentiation			0.95
Well	7 (20.59)	8 (20.00)	
Moderate	27 (79.41)	32 (80.00)	
Clinical T stage			0.653
T1	7 (20.59)	10 (25.00)	
T2	27 (79.41)	30 (75.00)	
Neoadjuvant CRT	6 (17.65)	7 (17.50)	0.987

Data are presented as n (%) or mean ± standard deviation.
BMI, body mass index; CEA, carcinoembryonic antigen; CA19-9, carbohydrate antigen 19-9; ASA, American Society of Anesthesiologists; CRT, chemoradiotherapy.

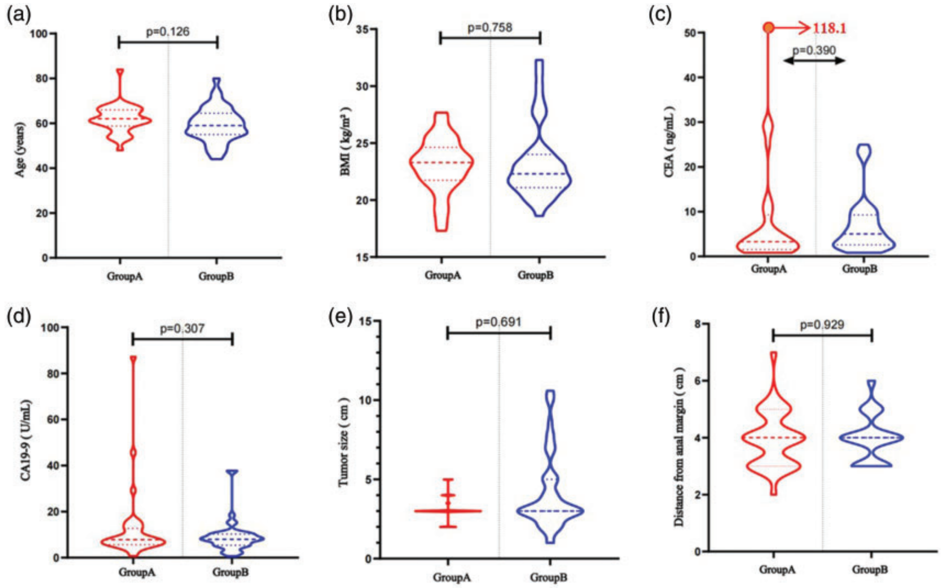

Figure 2. The shape of the violin plots illustrates the kernel density estimation of the respective distribution, including (a) age, (b) BMI, (c) CEA, (d) CA19-9, (e) tumor size, and (f) distance from anal margin. BMI, body mass index; CEA, carcinoembryonic antigen; CA19-9, carbohydrate antigen 19-9.

Surgery-related indicators

The operative results are summarized in Table 2. There were no significant differences between Groups A and B in the operation time (189.97 ± 13.75 vs. 181.48 ± 22.14 min) (Figure 3(a)), intraoperative blood loss (47.35 ± 23.00 vs. 46.00 ± 21.93 mL) (Figure 3(b)), number of dissected lymph nodes (12.00 ± 3.28 vs. 11.15 ± 3.48) (Figure 3(c)), or first time out of bed after the operation (3.32 ± 0.68 vs. 3.32 ± 0.89 days) (Figure 3(d)). However, the first postoperative exhaust time (2.62 ± 0.60 vs. 3.00 ± 0.85 days, $P = 0.0310$) (Figure 4(a)), first postoperative defecation time (3.56 ± 1.13 vs. 4.33 ± 1.19 days, $P = 0.006$) (Figure 4(b)), postoperative time to removal of the abdominal drain (8.24 ± 0.96 vs. 11.02 ± 5.89 days, $P = 0.008$) (Figure 4(c)), and postoperative hospital stay (12.00 ± 2.65 vs. 14.53 ± 5.75 days, $P = 0.021$) (Figure 4(d)) were significantly shorter in Group A than in Group B.

The details of the postoperative TNM stage of the tumors were as follows. In Group A, 15 (44.12%) patients had stage I tumors, 10 (29.41%) had stage II, and 9 (26.47%) had stage III. In Group B, 14 (35%) patients had stage I tumors, 14 (35%) had stage II, and 12 (30%) had stage III. After an average follow-up of 26 months, there was no significant difference in the complications between Group A (one anastomotic leakage and one anastomotic stricture) and Group B (eight anastomotic leakages and one incisional infection). However, the incidence of anastomotic leakage was significantly lower in Group A than in Group B (2.94% vs. 20.00%, $P = 0.033$) (Table 2).

Preoperative and postoperative nutritional status indicators and systemic stress response indicators

There were no significant differences in the nutritional status and systemic stress

Table 2. Surgery-related indicators (n = 74).

	Group A	Group B	*P*
Operation time, minutes	189.97 ± 13.75	181.48 ± 22.14	0.056
Intraoperative blood loss, mL	47.35 ± 23.00	46.00 ± 21.93	0.797
Number of dissected lymph nodes	12.00 ± 3.28	11.15 ± 3.48	0.285
First postoperative exhaust time, days	2.62 ± 0.60	3.00 ± 0.85	0.031
First postoperative defecation time, days	3.56 ± 1.13	4.33 ± 1.19	0.006
First time out of bed after the operation, days	3.32 ± 0.68	3.32 ± 0.89	0.994
Postoperative time to removal of the abdominal drain, days	8.24 ± 0.96	11.02 ± 5.89	0.008
Postoperative hospital stay, days	12.00 ± 2.65	14.53 ± 5.75	0.021
Postoperative TNM stage			0.723
I	15 (44.12)	14 (35.00)	
II	10 (29.41)	14 (35.00)	
III	9 (26.47)	12 (30.00)	
Complications			0.055
Anastomotic leakage	1 (2.94)	8 (20.00)	
Anastomotic stricture	1 (2.94)	0 (0.00)	
Incisional infection	0 (0.00)	1 (2.50)	
Anastomotic leakage			0.033
Yes	1 (2.94)	8 (20.00)	
No	33 (97.06)	32 (80.00)	

Data are presented as n (%) or mean ± standard deviation.

response indicators between the two groups before the operation or on the first postoperative day. Moreover, on the fifth postoperative day, we found that the CRP concentration (70.85 ± 13.98 vs. 72.32 ± 18.78 mg/L) and WBC count (7.58 ± 1.67 vs. 7.83 ± 1.91 10^9/L) were still not significantly different between the two groups. However, the serum concentrations of total protein (63.65 ± 3.42 vs. 59.00 ± 4.44 g/L, $P < 0.001$) and albumin (34.46 ± 3.38 vs. 31.53 ± 3.56 g/L, $P = 0.001$) were higher in Group A than in Group B on the fifth postoperative day. More specific details can be found in Table 3 and Figure 5.

Discussion

Because doctors must understand the anatomy of rectal cancer and patients are demanding higher quality of life, laparoscopic ISR has become the first-choice surgery for both patients and doctors. However, this operation increases the risk of anastomotic leakage to some extent.[22] Symptomatic anastomotic leakage is the most serious complication; it not only affects early complication rates and mortality but also affects the recovery of anal function,[23] overall survival,[24] and cancer-specific survival.[25] Therefore, reducing the incidence of anastomotic leakage is an important research direction in laparoscopic surgery for rectal cancer.

The relationship between prophylactic stoma creation and postoperative anastomotic leakage in patients with LRC has long been controversial. Eriksen et al.[26] reported that a prophylactic stoma could reduce the risk of anastomotic leakage by 60% in patients with rectal cancer whose anastomotic distance from the anal edge was less than 6 cm. Law et al.[15] also reported beneficial effects of prophylactic stomas, which not only reduced the serious consequences of anastomotic leakage but also inhibited the incidence and mortality of anastomotic leakage requiring

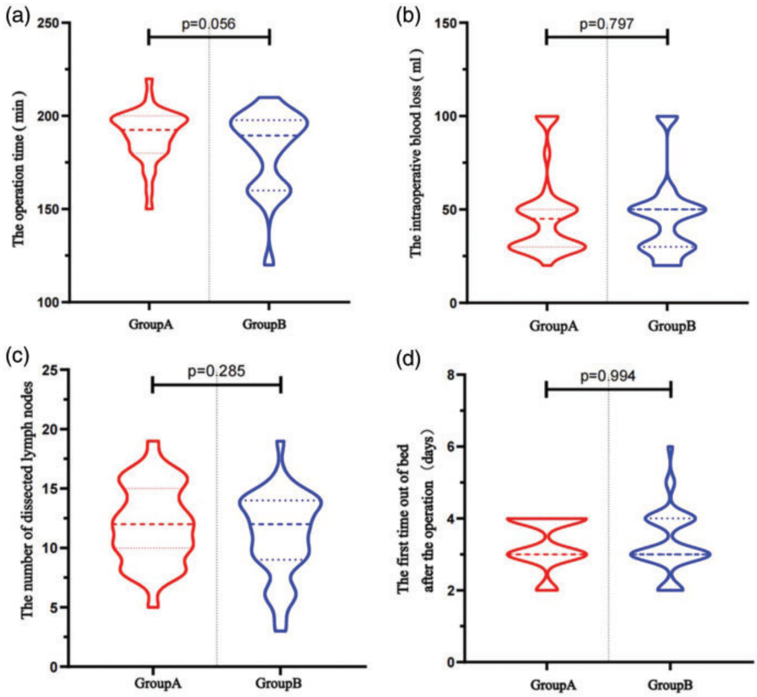

Figure 3. Violin plots between Groups A and B in terms of the (a) operation time, (b) intraoperative blood loss, (c) number of dissected lymph nodes, and (d) first time out of bed after the operation.

reoperation. However, some scholars have argued that prophylactic ostomy increases the risk of stoma-related complications, has no significance for the incidence of postoperative anastomotic leakage, and does not alleviate the severity of anastomotic leakage.[27] In the present study, there was no significant difference in the occurrence of complications between the two groups. However, the incidence of anastomotic leakage was significantly lower in Group A than in Group B ($P = 0.033$). The results showed that prophylactic transverse colostomy based on CLAPISR could reduce the incidence of anastomotic leakage by 17% and play a beneficial role in prevention and protection, which is consistent with the results of a meta-analysis in 2021.[28] We believe that prophylactic transverse colostomy has the function of diversion, which can avoid large amounts of feces and bacteria from gathering near the anastomosis, relieve the pressure in the intestine, facilitate healing of the anastomosis, and reduce the occurrence of anastomotic leakage. Analysis of the complications in Group A revealed one grade A anastomotic leakage and one anastomotic stricture, which were cured by conservative treatment and postoperative anal dilatation, respectively. Analysis of the complications in Group B revealed five grade B and C anastomotic leakages and one incisional infection. The hospital stay was significantly longer in Group B than in Group A ($P = 0.021$), which also confirmed that the absence of a stoma aggravates the symptoms of anastomotic leakage, prolongs the hospital stay, and increases the probability of infection. Therefore, prophylactic transverse

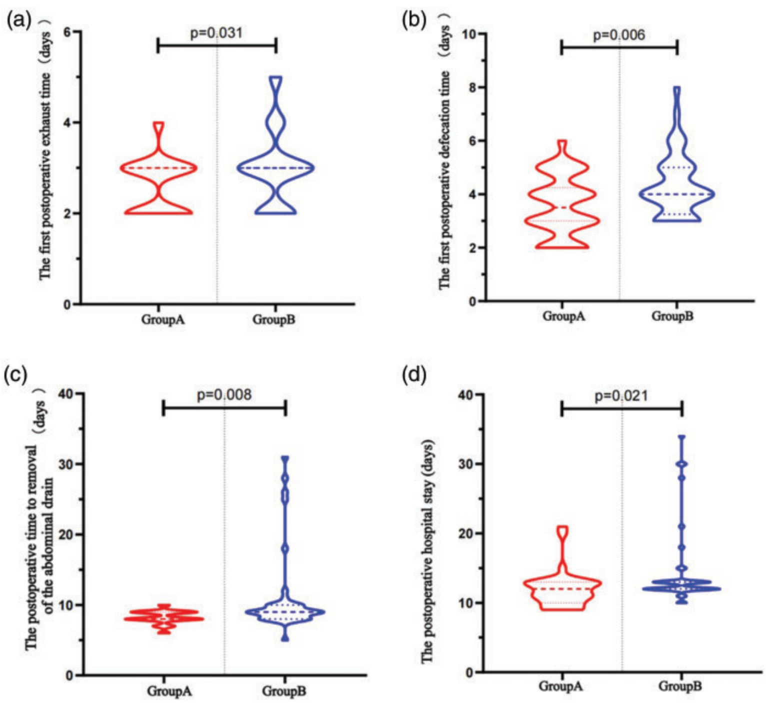

Figure 4. Violin plots between Groups A and B in terms of the (a) first postoperative exhaust time, (b) first postoperative defecation time, (c) postoperative time to removal of the abdominal drain, and (d) postoperative hospital stay.

Table 3. Preoperative and postoperative nutritional status indicators and systemic stress response indicators in patients.

	Group A	Group B	*P*
Preoperative serum total protein, g/L	66.79 ± 3.79	66.00 ± 4.33	0.411
Serum total protein on first postoperative day, g/L	55.33 ± 3.77	56.11 ± 3.61	0.371
Serum total protein on fifth postoperative day, g/L	63.65 ± 3.42	59.00 ± 4.44	<0.001
Preoperative serum albumin, g/L	35.91 ± 3.59	36.45 ± 2.98	0.479
Serum albumin on first postoperative day, g/L	29.27 ± 3.89	29.93 ± 4.25	0.492
Serum albumin on fifth postoperative day, g/L	34.46 ± 3.38	31.53 ± 3.56	0.001
Preoperative WBC count, 10^9/L	5.66 ± 1.55	6.05 ± 2.80	0.465
WBC count on first postoperative day, 10^9/L	11.90 ± 2.05	12.94 ± 3.13	0.1
WBC count on fifth postoperative day, 10^9/L	7.58 ± 1.67	7.83 ± 1.91	0.553
Preoperative CRP, mg/L	5.96 ± 2.43	5.91 ± 2.27	0.937
CRP on first postoperative day, mg/L	103.66 ± 19.59	100.79 ± 24.80	0.587
CRP on fifth postoperative day, mg/L	70.85 ± 13.98	72.32 ± 18.78	0.708

Data are presented as mean ± standard deviation.
WBC, white blood cell count; CRP, C-reactive protein.

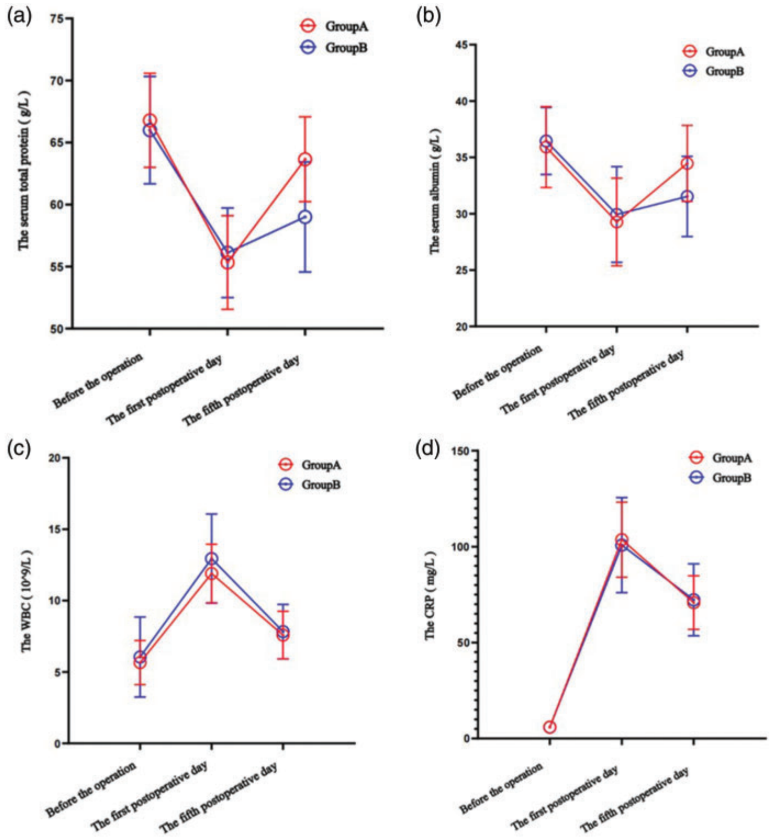

Figure 5. Violin plots of preoperative and postoperative nutritional status indicators and systemic stress response indicators in patients. WBC, white blood cells; CRP, C-reactive protein.

colostomy positively impacts patients with LRC undergoing CLAPISR and is worthy of clinical application.

The recovery of gastrointestinal function in patients with LRC is also essential. The occurrence of postoperative exhaust and defecation means that the intestinal function has been restored, and the patient can then eat. The first postoperative exhaust ($P = 0.031$) and defecation ($P = 0.006$) occurred earlier in Group A than in Group B. Early enteral nutritional support can stimulate the secretion of gastrointestinal hormones and accelerate intestinal peristalsis, which facilitates the absorption of nutrients and rapid physical recovery after surgery.[29] The hospital stay was significantly shorter in Group A than in Group B ($P = 0.021$), and the postoperative time to removal of the abdominal drain was 3 days earlier in Group A than in Group B ($P = 0.008$). These results again confirm that prophylactic transverse colostomy has certain advantages and aligns with the concept of enhanced recovery after surgery.

We evaluated the effects of prophylactic transverse colostomy on the postoperative nutritional status and stress response according to the serum total protein concentration, serum albumin concentration, WBC count, and CRP concentration. Our results showed no significant difference in the serum total protein concentration or serum albumin concentration between the two groups before the operation or on the first postoperative day. However, on the fifth postoperative day, the protein and albumin concentrations were higher in Group A than in Group B. There was no significant difference in the WBC count or CRP concentration before the operation, on the first postoperative day, or on the fifth postoperative day in the two groups. These results demonstrate that prophylactic transverse colostomy did not increase the patients' surgical stress but effectively improved their postoperative nutritional status and facilitated physical recovery. Moreover, surgeons' rich surgical experience, the concept of fine intraoperative anatomy, and the protection of important blood vessels are keys to shortening the operation time and reducing intraoperative blood loss. Hence, there was no statistically significant difference in the operation time or intraoperative blood loss between the two groups.

Overall, the present study indicates that prophylactic transverse colostomy has advantages over non-colostomy and can be recommended for routine application in CLAPISR. However, this study also has two main limitations: the sample size was small and we did not analyze the effect of anastomotic leakage on postoperative anal function and mortality. In the future, we will increase the number of patients to explore whether prophylactic transverse colostomy can benefit patients with LRC undergoing CLAPISR and obtain more accurate and objective results.

Conclusion

Among the patients with LRC undergoing CLAPISR in this study, those in Group A experienced better postoperative nutritional recovery, faster recovery of gastrointestinal function, and a lower incidence of anastomotic leakage than patients in Group B. These findings indicate that prophylactic transverse colostomy based on CLAPISR is safe and feasible and deserves further clinical promotion.

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Ethics approval and consent to participate

The Ethics Review Committee of the Affiliated Hospital of Chengde Medical University approved this study (permit number: LL2020397). Data were obtained from the medical records database of the Affiliated Hospital of Chengde Medical University. Patient consent was not required because of the retrospective nature of this study.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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Availability of data and materials

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Author contributions

Conceptualization: H.Z. and E.Z.; data curation: H.Z. and Z.L.; formal analysis: H.Z., S. Z., and J.L.; methodology: H.Z., J.Y., and Z. L.; supervision: E.Z.; writing – original draft: H.Z.; writing – review and editing: H.Z., Z.L., R.S., and E.Z.

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