Feasibility Analysis and Advantages of Wedge Resection Plus Transverse Suture Applied to Closure of Loop Ileostomy

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Research Article

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Abstract

Objectives: To evaluate the feasibility and advantages of wedge resection plus transverse suture applied to loop ileostomy closure by analyzing the surgical data and the incidence of postoperative complications of patients undergoing this procedure.

Methods: We performed a retrospective analysis of the hospitalization data of patients who underwent ileostomy closure surgery and met the research standards from January 2017 to April 2021 in the Guangxi Medical University Cancer Hospital; all surgeries were performed by the same surgeon. The perioperative data were statistically analyzed by grouping.

Results: In total, 65 patients were enrolled in this study, with 12 in the wedge resection group, 35 in the stapler group, and 18 in the hand suture group. There was no significant difference in operation time between the wedge resection group and stapler group ($P > 0.05$), but both groups had shorter operation time than that in the hand suture group ($P< 0.05$). The postoperative exhaustion time of wedge resection group was earlier than that of the others, and cost of surgical consumables in the wedge resection group was significantly lower than that in the stapler group, all with statistically significant differences ($P< 0.05$). By contrast, there was no statistically significant difference in postoperative complication incidences among the three groups.

Conclusions: The wedge resection plus transverse suture is safe and easy for closure of loop ileostomy, and the intestinal motility recovers rapidly postoperatively. It has less surgical consumables, and is particularly suitable for the currently implemented Diagnosis-Related Groups payment method.

Introduction

With the development of treatment technologies such as minimally invasive laparoscopy and internal rectal sphincterotomy, the indications for anus-preserving surgery in patients with rectal cancer have been expanded, and the anus preservation rate for patients with low rectal cancer has been greatly improved(1–3); however, it also increases the risk of postoperative anastomotic leakage(4, 5). Once anastomotic leakage occurs, it will lead to serious complications and consequences, such as pelvic infection, anastomotic stenosis, and defecation dysfunction(6). To reduce the incidence and the associated serious consequences, the establishment of temporary loop ileostomy to shunt stool is a common preventive measure(7, 8). Under normal circumstances, three months after radical operation and full rectal anastomotic stromal healing, the ileostomy closure surgery is performed to close the temporary stoma and restore normal anatomy and physiology. In the past, the commonly used surgical methods for ileostomy closure surgery included the hand suture method (end-to-end anastomosis) and stapler method (end-to-end, end-to-side, or side-to-side anastomosis), each with their own advantages and disadvantages. Although many reports have compared and analyzed the advantages of these two methods, the first-choice surgical treatment has yet to be made clear(9–12). Particularly, the stapler anastomosis method is widely welcomed owing to its simple operation, shorter operation time, and firm

anastomosis(13, 14); however, its application of expensive staplers leads to high anastomotic costs, which further increases the patients' total hospitalization costs and the country's medical insurance costs.

At present, medical insurance expenditures impose a great burden in the financial expenditures of countries worldwide, especially in developing countries with a large population base such as China, wherein medical insurance expenditures are large and the country's financial burden is heavy(15). Therefore, to reduce the national financial burden, China has begun to implement the diagnosis-related groups (DRG) payment method to limit the hospitalization expenses of patients. From an economic perspective, if the wedge resection plus transverse suture method can be applied to ileostomy reversal, it will significantly reduce the patients' hospitalization costs and the national medical insurance burden.

Generally, the wedge resection (on the mesangial side) plus transverse suture method has been used in intestinal fistula repairs, with better intestinal conditions and less pollution(16). Despite this, in previous ileostomy closure surgeries, we have found that in cases where intestinal adhesion with local skin and mucosal inflammation are mild, the adhesion between the intestine and the abdominal wall can be decreased, while avoiding intestinal injury of the stoma. Additionally, the ileostomy ring resembles a fistula with no evident infection and with good local intestinal tract conditions, making it feasible for local excision and repair. However, whether the wedge resection plus transverse suture method is safe and feasible for ileostomy closure has been rarely reported.

Therefore, this research applied the wedge resection plus transverse suture method to ileostomy reversal and compared it with the two surgical methods — stapler side-to-side anastomosis and hand suture end-to-end anastomosis — in terms of operation time, intraoperative blood loss, postoperative exhaustion time, postoperative complications within 30 days, cost of surgical consumables, and other observation indicators, to analyze this method's feasibility, safety, and economic benefits, among others.

Materials And Methods

This study had a retrospective design conducted in the Department of Gastrointestinal Surgery, Guangxi Medical University Cancer Hospital, wherein the hospitalization data were collected from patients who underwent ileostomy closure surgery performed by the same attending physician from January 2017 to April 2021. Patients with other serious gastrointestinal diseases, severe cardiovascular and cerebrovascular diseases other than the underlying disease, or those with missing hospitalization data were excluded from this study. According to the different surgical methods of ileostomy reversal, the patients were divided into the wedge resection group, stapler group, and hand suture group.

All patients signed the informed consent forms. All patients underwent the same perioperative treatment except for the different surgical anastomosis methods. Next, the intestines were routinely cleaned, and prophylactic antibiotics were used 30 minutes before surgery. The anastomotic seromuscular layer was then reinforced during the surgery, and no abdominal drainage tubes or subcutaneous drainage strips were routinely indwelled. After surgery, all patients underwent fasting, wherein liquid diet could be taken

after the release of gas through anus, and they received symptomatic treatment, such as nutritional support, antibiotics, wound dressing, etc.

Wedge resection plus transverse suture method

The main technical points were as follows: a fusiform incision was made around the stoma; the intestinal segment of the stoma was then fully freed; afterwards, the stoma edge was trimmed, and the adhesive skin and tissue were removed (Figure 1). After resection, intermittent full-thickness sutures were performed along the transverse axis of the intestinal tube (Figure 2a, b).

Observation indicators

The hospitalization data of the included patients were collected, with the main observation indicators, namely, operation time, intraoperative blood loss, surgical consumables cost, postoperative exhaustion time, postoperative length of hospital stay, secondary operation rate, readmission rate, and postoperative complication incidence, especially the occurrence of anastomotic bleeding, anastomotic leakage, continuous vomiting, abdominal distension, and intestinal obstruction within 30 days after surgery. Particularly, the second operation rate and readmission rate were defined as the proportion of reoperation and readmission for the required treatment due to complications after ileostomy closure surgery within 30 days, respectively.

Statistical analysis

SPSS 25.0 statistical software (IBM Corp, Armonk, NY, USA) was used in this study. A comparison of attributes between groups was performed using c^2 test. A comparison between the groups was performed using a t-test, analysis of variance, or Least Significant Difference-t test. Moreover, correlation analysis was performed using linear regression, and $P < 0.05$ indicated that the differences in all the tests were statistically significant.

Results

In total, 65 patients were included in this study. Among them, 12 were included in the wedge resection group, 35 were in the stapler group, and 18 were in the hand suture group. The baseline data of the three groups of patients, namely, sex, age, body mass index, underlying diseases, and preoperative radiotherapy history, are shown in Table 1.

Table 1
Basic baseline characteristics in the three groups

	Wedge resection (n = 12)	Stapler (n = 35)	Hand suture (n = 18)
Sex	7	27	13
Male	5	8	5
Female			
Age (years,range)	60.5(36–74)	63(37–78)	64.5(41–85)
BMI(kg/m^2)	21.50 ± 4.04	22.46 ± 3.17	21.77 ± 2.99
Underlying diseases	7	13	11
Yes	5	22	7
No			
Preoperative radiotherapy history	1	13	2
Yes	11	22	16
No			
BMI body mass index, *kg* kilogram, *m* meter			

In terms of operation time and postoperative length of hospital stay, there was no statistically significant difference between the wedge resection group and the stapler group, but both groups had a shorter operation time and postoperative length of hospital stays than the hand suture group (91.17 min vs. 118.50 min, P = 0.001, 5.58 days vs. 7.50 days, P = 0.001, respectively).

In terms of surgical consumable cost, there was no statistically significant difference between the wedge resection group and the hand suture group (P = 0.469). However, the cost in the wedge resection group was significantly lower than that in the stapler group, the difference was statistically significant (2,253.82 yuan vs. 8,008.05-yuan, P < 0.001).

In terms of postoperative exhaustion time, the wedge resection group had an earlier recorded time than the stapler and hand suture groups, with statistically significant differences (2.08 days vs. 2.49 days, P = 0.029, and 2.08 days vs. 2.61 days, P = 0.011, respectively).

By contrast, there was no statistically significant difference in terms of intraoperative blood loss among the three groups (P = 0.822). The data of the three patient groups are shown in Table 2. In this study, no patients died due to ileostomy closure surgery. The total postoperative complication incidence was 12.31%, and the difference between the groups was not statistically significant (0, 11.43%, 22.22%, P = 0.187). The specific data of postoperative complications are shown in Table 3. Moreover, the three patient

groups did not require a second operation or readmission for postoperative complications within 30 days after surgery.

Table 2
Data analysis in the three groups

	Wedge resection (n = 12)	**Stapler (n = 35)**	**Hand suture (n = 18)**	***P* value**
Operation time(min)	91.17 ± 15.99	93.69 ± 20.26	118.50 ± 28.00	< 0.001
Intraoperative blood loss (ml)	15.00 ± 4.77	24.14 ± 21.54	27.50 ± 25.22	0.822
Surgical consumables cost (yuan)	2253.82 ± 794.60	8008.05 ± 1223.51	1954.88 ± 1005.96	< 0.001
Postoperative exhaustion time (days)	2.08 ± 0.51	2.49 ± 0.51	2.61 ± 0.61	0.031
Postoperative length of hospital stays (days)	5.58 ± 1.31	4.63 ± 1.11	7.50 ± 2.15	< 0.001
Postoperative complication incidence	0	4	4	0.187
Yes	12	31	14	
No				
min minute, *ml* milliliter				

Table 3
The incidence and mortality of postoperative complications in the three groups

	Wedge resection(n = 12) n(%)	Stapler(n = 35) n(%)	Hand suture(n = 18) n(%)
Death	0	0	0
Anastomotic leakage	0	0	0
Anastomotic bleeding	0	0	0
Intestinal obstruction	0	0	0
Postoperative continuous vomiting	0	0	0
Postoperative abdominal pain and distension[a]	0	0	1(5.6)
Wound infection	0	1(2.9)	0
Postoperative fever(≥38.2℃)[a]	0	3(8.6)	4(22.2)
[a]Multiple complications can occur simultaneously in one person.			

Discussion

With the implementation of the DRG payment method, the medical insurance payer no longer pays according to the patient's actual hospital expenditure, but he now pays according to the related groups, such as type, severity, treatment, and other conditions, of the patient's disease(17, 18). Under the premise of ensuring patient quality treatment and to save medical costs and reduce economic burden, hospitals need to actively reduce and control treatment costs. In this study, the wedge resection and hand suture groups only needed to apply surgical sutures to complete intestinal anastomosis with low cost, while the stapler group required an expensive stapler and a total of 2 pieces of 80 mm anastomosis nails, making the anastomotic cost higher. Moreover, the wedge resection group needed to suture only part of the intestine transversely without involving the mesangial intestinal wall and blood vessels, among others, while the hand suture anastomosis group required a full-peripheral intestinal anastomosis, needing more sutures in a wider range. Therefore, compared with stapled anastomosis and hand suture anastomosis, wedge resection plus transverse suture was more economical and cost-effective.

Adequate blood supply is the most important factor for establishing intestinal anastomosis(19). As such, the wedge resection plus transverse suture method does not require mesenteric vessel ligation and disconnection or stoma intestinal tube cutting and disconnection, which maximizes the anastomotic blood supply in the most physiological manner while avoiding leaks caused by intestinal ischemia. However, the stapler anastomosis or hand suture end-to-end anastomosis requires cutting the intestinal tube and part of the stoma mesentery, resulting in a certain distance between the closed end of the

anastomotic stoma or the common opening and the mesangial margin. Theoretically, this distance should not be greater than 1 cm; otherwise, it would be extremely easy to cause ischemia of the anastomotic stoma or a closed orifice with consequent anastomotic leakage(20). For hand-sewn end-to-end anastomosis, the diameter of the intestine segment at the distal end of the stoma can be significantly reduced owing to its prolonged exclusion; however, the diameter of the two ends is inconsistent, which can also increase the risk of anastomotic leakage or stenosis.

Studies including that of Löffler et al. have observed that stapler anastomosis takes less time than hand suture anastomosis, which makes performing the procedure more conveniently(9, 10). Although the intestinal tube needs to be disconnected in stapler anastomosis, the disconnection of the ostomy intestinal tube and the closure of the common opening are conveniently and quickly completed at one time, which can shorten the time of intestinal tube anastomosis. Meanwhile, the wedge resection used in this study did not require mesenteric blood vessel ligation and intestinal tube disconnection, but it required only trimming of the stoma edge with hand suture transverse suturing later. Although there were few intestinal tubes that needed to be sutured and there was no difference in the operation time when compared to the stapler group, the hand suture anastomosis group required many surgical steps. Compared with the wedge resection group or the stapler group, the operation time required was the longest, which is consistent with the data of this study. This showed that the wedge resection plus transverse suture method and stapler anastomosis are better than hand suture anastomosis in terms of operation time. Although there was no statistically significant difference in terms of intraoperative blood loss among the three patient groups in this study, both stapled and hand suture anastomosis required mesentery ligation, which objectively increases the bleeding risk. By contrast, the bleeding risk of wedge resection is lower, and the safety is higher.

The gastrointestinal motility of the three patient groups recovered to normal after the operation, and the patients experienced release of gas through the anus within 2–3 days; however, the patients who underwent wedge resection plus transverse suture had an earlier postoperative exhaustion time. This may be because the intestine was not disconnected by this method. Moreover, the closure operation was completed in the most suitable way for intestinal physiology, reducing nerve plexus damage in the intestinal wall. After the operation, the intestinal wall of the stoma could still be quickly adjusted using the nerves to promote the peristalsis of the smooth muscle of the small intestine(21). Through correlation analysis, it was found that the postoperative length of hospital stay was mainly related to the operation time, postoperative exhaustion time, and postoperative complications. The longer the duration of operation or the later the postoperative exhaustion, the longer the postoperative length of hospital stay. Furthermore, in the case of serious postoperative complications such as intestinal paralysis, anastomotic leakage, anastomotic bleeding, or anastomotic obstruction, the patient’s postoperative recovery is delayed and a longer length of hospital stay is required, possibly with a required second operation(22). In this study, the patients were able to recover well and were discharged after an average of five days following closure surgery. None of the previously mentioned complications occurred.

The total incidence of postoperative complications (including postoperative abdominal pain, abdominal distension, postoperative fever, and wound infection) in this study was 12.31%. There was no statistically significant difference between the groups, but there was heterogeneity in each study site(23–25). Although there were no significant differences in the incidence among the three groups, the postoperative complication rate of the stapler group or the hand suture anastomosis group was higher than that of the wedge resection group (11.43% and 22.22% vs. 0%, respectively). Another point worth discussing is the rate of secondary operations or rehospitalization, which was mainly a surgical measure taken due to serious postoperative complications, especially the occurrence of anastomotic bleeding or anastomotic obstruction, which cannot be treated with conservative measures. All patients with postoperative complications become better after active treatment.

In previous years, wedge resection was rarely used in the closure of ileostomy, which may have been due to issue about surgical factors causing anastomotic stenosis. We believe that after trimming the edges of the stoma and removing the adhesive skin and tissues, the possibility of postoperative anastomotic stenosis becomes very low when using the transverse suture method following the traditional surgical principle of “longitudinal resection and transverse suture.” Additionally, the anastomotic ring can intraoperatively accommodate a transverse finger for all patients after the intestinal repair is performed, given that no case of postoperative anastomotic stenosis has been attributed to this. In the past, considering the serious adhesion between the stoma and the abdominal wall, it was difficult to separate the normal intestinal tube without damage, and the wedge resection plus transverse suture method was not used. Despite this, for a skilled attending physician or a more senior doctor, it was not a problem to avoid intestinal injury through delicate surgical operations. Therefore, wedge resection plus transverse suture, as a surgical method for ileostomy reversal, is safe and easy to perform, has sufficient advantages for anastomotic blood supply, and it is a surgical method worth exploring.

Despite these findings, the study has certain limitations because the sample size was small and the evidence strength was not high, which may even have promoted selection bias. In the future, there is a need for randomized controlled trials with expanded sample sizes and long-term follow-ups to verify the feasibility and advantages of this surgical method.

Conclusion

Wedge resection plus transverse suture method is easy to operate, has reliable blood supply, does not increase postoperative complication incidence, and allows quick recovery of the intestinal motility after surgery. Moreover, it is safe and feasible for ileostomy reversal, and the cost of consumables required for surgery is small, making it particularly suitable for the DRG payment method for medical insurance. Thus, this is a recommended method for ileostomy closure surgery.

Declarations

Ethics approval statement and consent to participate

Written informed consent was obtained from all participants before surgery. The methods were carried out in accordance with the Declaration of Helsinki, and our study has been approved by the Ethics Committee of Guangxi Medical University Cancer Hospital (LW2021074).

Consent for publication

Consent for publication was obtained in writing from the patients.

Availability of data and material

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Competing interests

The authors report no conflict of interest.

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Author contribution

Each author had made substantial contributes to the conception or design of the work: The research topic was designed by XM and HQ; Data processing and article writing were performed by JL as a major contributor; Data analysis was finished by WW, LM and ZH. XM was corresponding author and approved the submitted version. All the authors read and approved the final manuscript.

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Figures

Figure 1

The picture shows that intestinal segment of the stoma was fully freed, afterwards, the stoma edge was trimmed, and the skin and tissue were removed.

Figure 2

Intermittent full-thickness sutures were performed along the transverse axis of the intestinal tube. (a) Front view. (b) Side view.