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Original Article

The effects of uncut Roux-en-Y anastomosis on laparoscopic radical gastrectomy patients' postoperative complications and quality of life

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Abstract: Objectives: This study discusses and analyzes the effects of uncut Roux-en-Y anastomosis on the postoperative complications and quality of life of gastric cancer patients after they undergo laparoscopic total gastrectomies. Methods: 86 patients admitted to our hospital for laparoscopic digestive tract reconstruction after distal gastrectomies were recruited as the study cohort and divided into group A (n=41) or group B (n=45) on the basis of the different digestive tract reconstruction surgery each patient underwent. The group-A patients underwent traditional Roux-en-Y anastomosis, and the group-B patients underwent uncut Roux-en-Y anastomosis. The operation outcomes, the early and late postoperative complications, the decline in the postoperative nutrition status, and the changes in the postoperative quality of life scores were compared between the two groups. Results: The intraoperative anastomosis times and the blood losses, the postoperative ventilation, the liquid food intake times, and the hospitalization durations in group B were lower than they were in group A ($P<0.05$). The incidences of early and late postoperative complications in group A was significantly higher than they were in group B ($P<0.05$). The decrease of the TP, ALB, and Hb levels in group B was dramatically lower than it was in group A at 6 months after the surgeries ($P<0.05$), and no significant difference in the TP, ALB, or Hb levels was observed between the two groups at 12 months after the surgeries ($P>0.05$). The QOL scores in the two groups of patients were increased at 6 and 12 months after the surgeries compared with 1 month after the surgeries ($P<0.05$). The QOL scores in group B were notably higher than they were in group A at 6 and 12 months after the surgeries ($P<0.05$). Conclusion: Uncut Roux-en-Y anastomosis after laparoscopic total gastrectomy is simple to carry out. The method can promote patients' early postoperative recovery, reduce their early and late complications, and maintain their postoperative nutritional status, thus improving their postoperative quality of life, so it is worthy of clinical promotion.

Keywords: Uncut Roux-en-Y anastomosis, laparoscopy, radical gastrectomy, complications, quality of life

Introduction

Gastric cancer is a common clinical malignancy of the digestive system. Due to its insidious onset, gastric cancer patients generally have no gastrointestinal symptoms or obvious clinical symptoms in the early stage [1]. Advanced gastric cancer patients often also have symptoms such as gastric pain, upper gastrointestinal discomfort or gastrointestinal bleeding, and the tumor cells can enter into the blood and lymphatic systems by proliferating and further spreading to various tissues and organs throughout the body [2]. Surgery is currently one of the preferred clinical treatments for gastric cancer, and laparoscopy has gradually become popular with the further development of the technology [3]. Laparoscopic gastrectomy refers to the removal of distal end of the gastric cancer. During the operation, the distal end of the stomach after the resection of the malignant tissue needs to be anastomosed with the intestine, and different anastomotic schemes will create different impacts directly on the postoperative recovery times and the patients' recoveries [4, 5]. The preferred digestive tract reconstruction not only ensures the safety of the operation, it also guarantees the nutritional needs and quality of life of the patients after their surgeries [6]. Currently, the

procedures used in digestive tract reconstruction after the total laparoscopic distal gastrectomies for gastric cancer are Billroth-I, Billroth-II, and Roux-en-Y anastomosis. The Billroth-I and Billroth-II procedures are relatively simple, but both have significant defects [7]. The Roux-en-Y anastomotic scheme, which includes traditional Roux-en-Y anastomosis and uncut Roux-en-Y anastomosis, is relatively complex but has wider indications and is in line with the physiological requirements of the human body, which effectively improve the patients' quality of life [8]. This study explored and analyzed the effect of the uncut Roux-en-Y anastomotic scheme on the postoperative complications and quality of life of laparoscopic total gastrectomy patients.

Case data and methods

Clinical data

86 patients admitted to our hospital from March 2016 to March 2019 and who underwent laparoscopic digestive tract reconstruction after total gastrectomies were selected as the study cohort. The patients were divided into group A (n=41) or group B (n=45) on the basis of the different digestive tract reconstruction each patient underwent. The study was approved by the ethics committee of the hospital.

Inclusion and exclusion criteria

Inclusion criteria: (1) The patients enrolled were diagnosed using gastroscopy and pathological examinations before their surgeries. (2) All the patients underwent a radical distal gastrectomy. (3) Patients who had stable vital signs after their surgeries, and (4) Patients who voluntarily signed the informed consent forms before the operation.

Exclusion criteria: (1) Patients with other vital organ diseases. (2) Patients with coagulopathy or mental illnesses. (3) Patients with immune system diseases. (4) Patients with surgical contraindications, or (5) Patients lost to follow-up or who died within 12 months after their surgeries.

Methods

The group-A underwent traditional Roux-en-Y anastomosis. The distal end of each patient's duodenal stump was closed, the jejunums was lifted and disconnected at a distance of 10-15 cm from the flexor ligament. We cut off the mesangial limbus of the distal end of the jejunum and the distal end of the greater curvature of the remnant stomach and used a linear cutting stapler to perform the side-to-side anastomosis of the remnant stomach before the colon. After the opening closed, we performed a side-to-side anastomosis of the proximal jejunum 30-50 cm away from the gastrojejunostomy and the proximal end of the jejunum using a straight-line cutting stapler, and we closed the opening after the completion of the anastomosis.

The group-B underwent uncut Roux-en-Y anastomosis. A residual gastro-jejunal anastomosis was performed 25 cm from the ligament of the flexion in the distal jejunum, and a side-to-side Braun anastomosis of about 5 cm was made at the site between the proximal and distal jejunums 15 and 30 cm from the gastrojejunostomy. The intestine was appropriately ligated 6 cm from the gastrojejunostomy between the two anastomoses to close the intestinal cavity. The ligation had to close the intestinal cavity without affecting the blood circulation or the nerve function.

Index observation

(1) The surgical conditions of the two groups, including the intraoperative anastomosis times and the blood loss, the lymph node dissection, the postoperative ventilation times, the liquid food intake times, and postoperative hospital stay durations were compared.

(2) The early and late complications in the two groups were statistically analyzed at 1 month and 6 months after the operations.

(3) Fasting venous blood from two groups was drawn before the surgeries, and again at 6 and 12 months postoperatively, and the nutritional status, including the serum total protein (TP), serum albumin (ALB), and hemoglobin (HB) levels was analyzed using an IMMAGE 800 protein analyzer (Beckman-Coulter, United States) to compare the TP, ALB, and Hb levels.

(4) The quality of life in the two groups at 1, 6, and 12 months after the surgery was assessed using the QOL scale [9]. The assessment was in the form of a questionnaire, with five

Table 1. A comparison of the clinical data between the two groups

Clinical data	A group (n=41)	B group (n=45)	t/X^2	*P*
Gender				
Male	27	27	0.315	0.575
Female	14	18		
Age (years, $\bar{x} \pm s$)	61.27±7.48	60.93±8.33	0.198	0.843
BMI (kg/m^2, $\bar{x} \pm s$)	21.64±3.42	22.03±2.78	0.583	0.562
Differentiation degree				
High	12	10	0.880	0.379
Medium	15	16		
Low	14	19		
TNM staging				
II	7	9	0.703	0.482
III	24	28		
IV	10	8		

aspects in daily life, activities, health, and support spirit. Each item was scored from 0-2 points, and the final scores ranged between 0-10 points. A higher score indicated a better quality of life.

(5) We followed-up the patients after their surgeries, including using outpatient follow-up, telephone, WeChat, etc., to record their progression-free survival (PFS). The PFS refers to the observation period from the day after the surgery to the end of the observation period of the disease progression, or until the patients died from any cause of death.

Statistical analysis

The data processing and analysis were conducted using SPSS 23.0. The comparison of measurement data was done using *t* tests, and the enumeration data compared using X^2 tests. P<0.05 was regarded as a statistically significant difference. Kaplan-Meier survival curves were drawn for the survival analysis, and log-rank tests were used to compare the differences in survival. The graphing software we adopted was GraphPad Prism 8.0.

Results

Comparison of the clinical data in the two groups

The two groups had statistically insignificant differences in their clinical data, such as gender, age, BMI, degree of differentiation, and TNM staging (P>0.05), as shown in **Table 1**.

Comparison of the surgical conditions between the two groups

No significant differences were observed in the two groups with respect to the total number of lymph node dissections (*P>0.05*), but the intraoperative anastomosis times, the blood loss, the postoperative ventilation times, the liquid food intake times, and the hospitalization stay durations postoperatively in group B were apparently less than they were in group A (*P<0.05*), as shown in **Table 2**.

Comparison of the recent postoperative complications between the two groups

The incidences of early postoperative complications in group A were critically higher than they were in group B (P<0.05), as shown in **Table 3**.

Comparison of the long-term postoperative complications between the two groups

The incidence of long-term postoperative complications in group A was notably higher than it was in group B (P<0.05), as shown in **Table 4**.

Comparison of the decreases in the postoperative nutritional statuses between the two groups

The decreases in the TP, ALB, and Hb levels in group B were dramatically lower than they were in group A at 6 months after the surgeries (*P<0.05*), and no significant differences in the TP, ALB, or Hb levels were observed between the two groups at 12 months after the surgeries (*P>0.05*) (**Table 5**).

Comparison of the postoperative QOL scores between the two groups

The two groups had no significant difference in their QOL scores at 1 month after the surgery (*P>0.05*), but they had increased QOL scores at 6 and 12 months after their surgeries compared with the 1 month scores (*P>0.05*). The

Table 2. A comparison of the surgical conditions between the two groups ($\overline{x}$ ± s)

Surgical condition	Group A (n=41)	Group B (n=45)	t	*P*
Intraoperative anastomosis time (min)	43.68±6.49	33.85±5.28	7.734	0.000
Intraoperative blood loss (ml)	43.59±5.83	31.67±6.74	8.732	0.000
number of lymph node dissections (quantity)	26.07±5.12	25.40±4.42	0.651	0.517
Postoperative ventilation (d)	2.85±0.46	2.16±0.39	7.524	0.000
Intake time of liquid food postoperatively (d)	4.10±0.61	3.38±0.45	6.266	0.000
length of hospital stay postoperatively (d)	10.75±2.04	8.96±1.69	4.446	0.000

Table 3. A comparison of the short-term postoperative complications between the two groups [n (%)]

Group	Anastomotic leakage	Anastomotic bleeding	Anastomotic obstruction	Duodenal stump fistula	Incision infection	Dysmotility of stomach	Total
A group (n=41)	2 (4.88)	5 (12.20)	1 (2.44)	3 (7.32)	5 (12.20)	4 (9.76)	20 (48.78)
B group (n=45)	0 (0.00)	1 (2.22)	0 (0.00)	1 (2.22)	2 (4.44)	2 (4.44)	6 (13.33)
X^2	-	-	-	-	-	-	12.780
P	-	-	-	-	-	-	0.000

Table 4. A comparison of the long-term postoperative complications between the two groups [n (%)]

Group	Reflux gastritis	Anastomotic stenosis	Dumping syndrome	Roux stasis syndrome	Total
A group (n=41)	6 (14.63)	3 (7.32)	6 (14.63)	3 (7.32)	18 (43.90)
B group (n=45)	3 (6.67)	1 (2.22)	3 (6.66)	2 (4.44)	9 (20.00)
X^2	-	-	-	-	5.691
P	-	-	-	-	0.017

Table 5. A comparison of the decreases in the postoperative nutritional statuses between the two groups (g/L, $\overline{x}$ ± s)

Group	Decrease in TP		Decrease in ALB		Decrease in Hb	
	6 months postoperatively	12 months postoperatively	6 months postoperatively	12 months postoperatively	6 months postoperatively	12 months postoperatively
Group A (n=41)	5.17±1.04	3.11±0.78	5.14±1.67	2.48±0.83	15.64±5.07	8.97±2.54
Group B (n=45)	3.46±0.79	3.02±0.83	4.08±1.23	2.51±0.79	9.80±2.75	8.73±1.73
t	8.632	0.517	3.372	0.172	6.720	0.516
P	0.000	0.607	0.001	0.864	0.000	0.607

QOL scores in group B were notably higher than they were in group A at 6 and 12 months after the surgeries (*P<0.05*), as shown as **Table 6** and **Figure 1**.

The postoperative follow-up of the two groups of patients

There was an insignificant difference in the PFS levels between the two groups (X^2=0.058, P=0.810), as shown in **Figure 2**.

Discussion

Gastric carcinoma is the second leading cause of cancer mortality in the world, and it accounts for about 10% of all cancer deaths [10]. In recent years, whole-process laparoscopic anastomosis has been shown to have the advantages of a good visual field and an accurate coincidence in the surgical treatment of gastric carcinoma, and it can better ensure the blood supply of anastomosis and reduce the risk of anastomotic stenosis [11, 12]. However, no unified conclusion has been reached to determine the best gastrointestinal reconstruction method after radical gastrectomy.

The traditional Roux-en-Y gastrointestinal reconstruction involves forming a blind end of the upper end of duodenum and anastomosing

Table 6. A comparison of the postoperative QOL scores between the two groups (points, $\bar{x} \pm s$)

Group	1 month postoperatively	6 months ostoperatively	12 months postoperatively
Group A (n=41)	3.65±1.20	5.74±0.97*	6.84±0.89*
Group B (n=45)	3.74±1.32	6.38±0.95*	7.85±0.93*
t	0.330	3.089	5.134
P	0.742	0.003	0.000

Note: compared with 1 month after the operation, **P<0.05.*

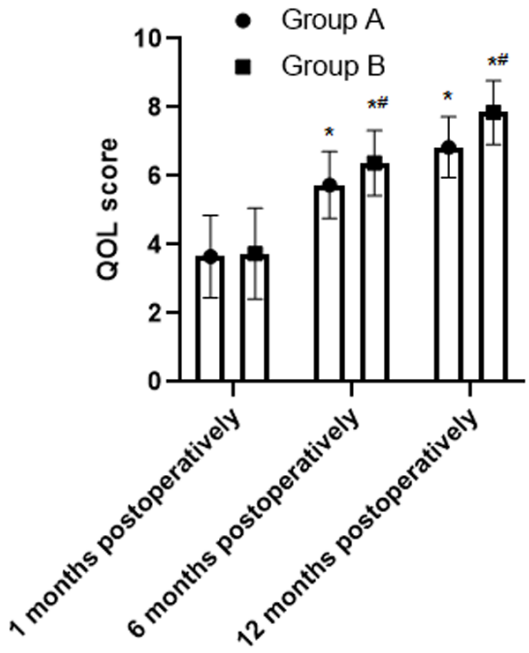

Figure 1. A comparison of the postoperative QOL scores between the two groups. Note: compared with 1 month after the operation, *P<0.05; compared with group A, *#P<0.05.*

the lower end of the duodenum to the upper part of the jejunum and the gastric stump. The operation is simple, and a satisfactory anastomosis effect can be achieved [13]. By changing the physiological structure of the digestive tract, this method can accelerate gastric emptying, reduce the secretions of gastric acid and pepsin, and meanwhile reduce the alkaline reflux caused by the damage to the vagus nerve [14]. However, the normal structure of the digestive tract is changed by the reconstruction of the Roux-en-Y digestive tract, and the physiological channel of the duodenum is abandoned, leading to an abnormal pacing potential in the small intestine and a decrease in the intestinal motor function, thus increasing the risk of complications such as retention syndrome [15, 16]. Patients are often deprived of nutrition due to dyspepsia and inadequate food intake after their surgeries, and this can have adverse effects on their quality of life [17].

Uncut Roux-en-Y gastrointestinal reconstruction is a new anastomotic scheme based on the Billroth II procedure. The moderate ligation of the intestinal tube between the anastomosis of the jejunum and the gastrojejunum can achieve the purpose of sealing the intestinal tube without affecting the blood circulation and nerve function [18, 19]. The proper closure of the intestinal cavity can reduce the reflux of alkaline digestive fluids and the risk of complications such as reflux gastritis, anastomotic ulcers and reflux esophagitis [1]. Meanwhile, this method will not damage the blood circulation or the nerve function of the small intestine, and it can protect the motor function of the small intestine, and reduce the risk of complications such as retention syndrome [20, 21].

In this study, the influence of the effects between the traditional Roux-en-Y and uncut Roux-en-Y schemes on patients after laparoscopic total gastrectomy were compared. The results showed that the intraoperative anastomosis times and the blood loss, the postoperative ventilation times, the liquid food intake times, and the hospitalization stay durations in group-B were less than they were in group A. The uncut Roux-en-Y reconstruction of the digestive tract, with the test results similar to those reported by other researchers [22, 23], is simpler in operation. It causes less damage to the human body, and it can help to promote the recovery of patients after their operations. The incidence of early and late postoperative complications in group A was critically higher than it was in group B. The use of uncut Roux-en-Y gastrointestinal reconstruction can help reduce the early and late complications of laparoscopic total gastrectomy patients, including anastomotic stenosis, reflux gastritis, delayed gastric emptying, and dumping syndrome. Uncut Roux-en-Y gastrointestinal reconstruction properly ligates the intestine and reduce the complications caused by the reflux of alkaline digestive fluids to a certain extent.

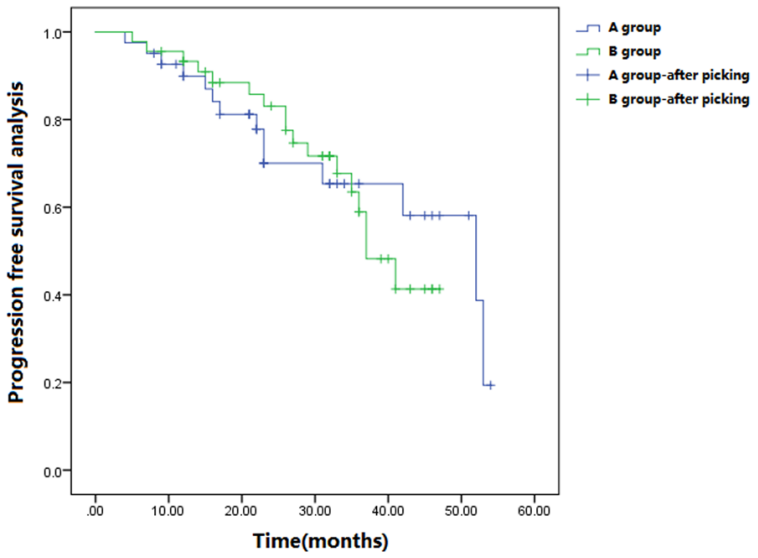

Figure 2. An analysis of the postoperative progression-free survival in the two groups.

At the same time, the operation can protect the motor function of the small intestine, thereby reducing the retention syndrome efficaciously [24].

The TP, ALB, and Hb levels are indicators that reflect the nutritional status of the human body. A decrease in the TP, ALB, and Hb levels in gastric cancer patients postoperatively can lead to a decline in immune function, which is not conductive to the anti-tumor function and will impose a negative clinical prognosis on the patients. This study focused on the impact of the two anastomotic methods on patients' nutritional status, and the results showed that the decrease of the TP, ALB and Hb levels in group B was critically lower than it was in group A at 6 months after the surgeries. This suggests that uncut Roux-en-Y gastrointestinal reconstruction is more conducive to the protection of the nutritional status of patients after surgery, as it retains the continuity of the jejunum and protects the postoperative absorption function of the intestine [25]. The QOL scores in group B were notably higher than The QOL scores in group A at 6 and 12 months after the surgeries, which further suggests that the use of uncut Roux-en-Y gastrointestinal reconstruction can help improve the quality of life of patients with gastric cancer.

This study is basically consistent with the results reported by other scholars [26], namely that uncut Roux-en-Y gastrointestinal reconstruction is easier to operate and causes less damage to the body. This method can effectively protect the motor function of small intestine at the same time, ensuring the postoperative nutrition absorption of patients, reducing the occurrence of postoperative complications, and contributing to the improvement of their living quality. However, it is still necessary to further expand the sample size and to extend the follow-up times to obtain more reliable clinical research data to determine whether the postoperative prognosis of patients is significantly influenced. In summary, laparoscopic radical gastrectomy with uncut Roux-en-Y anastomosis is simple to operate. The method can promote the early postoperative recovery of patients and reduce early and late complications. It helps to protect the patients' postoperative nutritional status and improve their postoperative quality of life, so it is worthy of clinical promotion.

Disclosure of conflict of interest

None.

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