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The primary aim of *World Journal of Gastrointestinal Oncology* (WJGO, *World J Gastrointest Oncol*) is to provide scholars and readers from various fields of gastrointestinal oncology with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

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Retrospective Cohort Study

Does the addition of Braun anastomosis to Billroth II reconstruction on laparoscopic-assisted distal gastrectomy benefit patients?

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Abstract

BACKGROUND

Operation is the primary therapeutic option for patients with distal gastrectomy. Braun anastomosis is usually performed after Billroth II reconstruction, which is widely applied on distal gastrectomy because it is believed to benefit patients. However, studies are needed to confirm that.

AIM

To identify whether the addition of Braun anastomosis to Billroth II reconstruction on laparoscopy-assisted distal gastrectomy benefits patients.

METHODS

A total of 143 patients with gastric cancer underwent laparoscopy-assisted distal gastrectomy at Centre 1 of PLA general hospital between January 2015 and December 2019. Clinical data of the patients were collected, and 93 of the 143 patients were followed up. These 93 patients were divided into two groups: Group 1 (Billroth II reconstruction, 33 patients); and Group 2 (Billroth II reconstruction combined with Braun anastomosis, 60 patients). Postoperative complication follow-up data and relevant clinical data were compared between the two groups.

RESULTS

There were no significant differences between Group 1 and Group 2 in postoperative complications (6.1% vs 6.7%, $P = 0.679$), anal exhaust time or blood loss. The follow-up prevalence of reflux gastritis indicated no significant difference between Group 1 and Group 2 (68.2% vs 51.7%, $P = 0.109$). The follow-up European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core-30 scores revealed no evident difference between Group 1

and Group 2 as well. Group 1 had a shorter operating time than Group 2 on average (234.6 min *vs* 262.0 min, $P = 0.017$).

CONCLUSION

Combined with Billroth II reconstruction, Braun anastomosis has been applied due to its ability to reduce the prevalence of reflux gastritis. Whereas in this study, the prevalence of reflux gastritis showed no significant difference, leading to a conclusion that under the circumstance of Braun anastomosis costing more time and more money, simple Billroth II reconstruction should be widely applied.

Key Words: Gastric cancer; Billroth II reconstruction; Braun anastomosis; Bile reflux

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Core Tip: Braun anastomosis is usually performed after Billroth II reconstruction, which is widely applied on distal gastrectomy because it is believed to benefit patients. This study indicated that the addition of Braun anastomosis to Billroth II reconstruction makes no significant difference in reducing the incidence of reflux gastritis.

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INTRODUCTION

Billroth I, Billroth II and Roux-en-Y reconstruction are the three most widely applied reconstructions for distal gastrectomy[1]. Among these reconstructions, Billroth II reconstruction is recognized to reduce a high proportion of patients with reflux gastritis, which decreases patient quality of life[2] and potentially leads to malignancy, gastritis and reflux esophagitis[3,4]. In accordance with recent studies, the incidence of reflux gastritis after Billroth II reconstruction varies from 40% to 90%[5-7]. The addition of Braun anastomosis has been performed after Billroth II reconstruction since 1885, aiming to reduce complications after Billroth II reconstruction.

However, based on the working experiences in the hospital, it was observed that patients who underwent Braun anastomosis could get serious reflux gastritis as well. Moreover, one recent study[8] found that the addition of a Braun anastomosis is not effective in preventing enterogastric bile reflux. Other studies suggested that Braun anastomosis has a minor impact on the incidence of reflux gastritis to pancreaticoduodenectomy[9,10] and one anastomosis gastric bypass[11]. Thus, whether Braun anastomosis can truly decrease the incidence of bile reflux to distal gastrectomy remains unknown.

The current study aimed to identify whether Braun anastomosis can truly decrease the incidence of bile reflux and improve the quality of life of the patients after Billroth II reconstruction on laparoscopic distal gastrectomy.

MATERIALS AND METHODS

Study design and data source

This retrospective cohort study was approved by our ethics committee at our institution. Between January 2015 and December 2019, a total of 143 patients with distal gastric cancer converted Billroth II reconstruction were collected in the 1st center of People's Liberation Army General Hospital (PLA general hospital), Beijing, China. Of these patients, follow-up data was available for 93. These 93 patients were divided into two groups: Group 1 (Billroth II reconstruction, 33 patients); and Group 2 (Billroth II reconstruction combined with Braun anastomosis, 60 patients).

Laparoscopic-assisted distal gastrectomy with D2 lymphadenectomy was performed on all of the patients under the conduct of the Japanese classification of gastric carcinoma and the guidelines for the treatment of gastric carcinoma[12,13]. The arteries and veins were cut in the laparoscopic vision and then a small incision (less than 10 cm) was made in the center of the abdominal wall.

Table 1 General patient characteristics

Characteristic	Billroth 2	Billroth 2 + Braun	P value
Age (yr)	56.8 ± 9.9	57.2 ± 11.4	0.834
Sex			0.784
Male	41	56	
Female	18	28	
Pathological tumor stage			0.89
1	5	7	
2	16	30	
3	12	23	
Operation time (min)	234.6 ± 47.7	262.0 ± 64.9	0.017
Blood loss (mL)	160.6 ± 130.9	136.2 ± 107.9	0.224
Anal exhaust time (d)	5.0 ± 2.0	3.8 ± 1.1	0.348

In Group 1, a small opening was made in the jejunum 20 cm away from the Treitz ligament on the anti-mesenteric margin and the residual gastric wall. The Billroth II anastomosis was performed with a 60 mm linear stapler in the end. In Group 2, jejunum-jejunum anastomosis was made 40 cm from the afferent limb.

Clinical data of the patients was collected, and 93 of the 143 patients were followed up. The follow-up data included: (1) The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core-30 scores[14] of patients; and (2) The number of patients with reflux gastritis. All of the follow-up was completed between January 2021 and June 2021. Postoperative complications, relevant clinical data and follow-up data were compared as well.

Participant selection

The inclusion criteria included: (1) Age from 18 to 75; (2) Pathologically diagnosed as distal gastric cancer; (3) Cancer pathological stage I-III (the 8th edition of the American Joint Committee on Cancer[15]); and (4) Complete clinical details. Exclusion criteria included: patients with serious heart disease or brain disease that influenced quality of life. A total of 143 patients were selected. Clinical data of the patients were collected and 93 of the 143 patients are followed up. Among the other 50 patients, 40 patients were out of contact and 10 patients were dead.

Outcomes definition

The main outcomes of this study were the incidence of reflux gastritis after the operation and The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core-30 scores, which is widely applied in a variety of clinical studies[16-18]. Patients were called and required to answer 30 questions from The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core-30. Scores were calculated based on five multi-item functional scales (emotional, physical, role, social and cognitive function), of which higher scores indicate better quality of life; three multi-item and six single-item symptom scores, of which higher scores indicate poorer quality of life. Reflux gastritis was diagnosed according to the gastroscopy reports.

Statistical analysis

All statistical analyses were performed with the support of SPSS v23.0 for Windows software. Continuous variables were expressed as mean ± SD and compared by Student's *t*-test. Categorical variables were analyzed by Pearson χ^2 test. A two-tailed *P* value < 0.05 was considered statistically significant.

RESULTS

There were 33 patients in Group 1 and 60 patients in Group 2. The age, pathological tumor stage, sex, mean blood loss and mean exhaust time between the two groups was similar, while group 2 had a significantly longer mean operation time (Table 1).

In comparison of postoperative complications, 1 of the 33 patients in Group 1 suffered from bile reflux and 2 patients had anastomotic fistula. In Group 2, 1 patient had anastomosis bleeding and 3 patients had anastomotic fistula. The total incidence of postoperative complications indicated no

Table 2 Postoperative complications

Complication	Billroth 2	Billroth 2 + Braun	P value
Bile reflux	1	0	1
Anastomosis bleeding	0	1	1
Anastomotic fistula	2	3	1
Total	3	4	0.696

Table 3 Follow-up data

	Group 1	Group 2	P value
Reflux gastritis			0.109
No	11	29	
Yes	22	31	
Incidence	66.70%	51.70%	
Multi-item functional scales			
Physical function	97.6 ± 0.95	92.7 ± 1.40	0.107
Cognitive function	98.9 ± 1.01	95.8 ± 1.40	0.126
Emotional function	94.4 ± 1.98	93.6 ± 1.54	0.744
Role function	97.5 ± 1.64	96.4 ± 1.19	0.592
Social function	96.5 ± 1.58	94.2 ± 1.67	0.369
Total function	84.3 ± 3.81	83.1 ± 2.25	0.757
Symptom			
Fatigue	1.85 ± 5.49	6.48 ± 9.21	0.1
Nausea/vomiting	2.78 ± 6.80	1.94 ± 4.70	0.695
Pain	0.01 ± 3.46	2.08 ± 4.76	0.258
Dyspnea	0.51 ± 2.90	1.39 ± 5.57	0.398
Appetite loss	1.52 ± 6.41	4.17 ± 10.00	0.173
Insomnia	3.03 ± 7.74	3.61 ± 9.75	0.769
Constipation	1.01 ± 5.80	3.06 ± 7.19	0.165
Diarrhea	4.55 ± 10.44	4.72 ± 10.22	0.937
Financial difficulty	2.02 ± 5.52	5.28 ± 11.68	0.135

Group 1: Billroth II reconstruction; Group 2: Billroth II reconstruction combined with Braun anastomosis.

significant difference between the two groups (Table 2).

During follow-up, 11 patients in Group 1 and 29 patients in Group 2 had reflux gastritis on their gastroscopy report during the postoperative review. The total incidence of reflux gastritis showed no significant difference (66.7% *vs* 51.7%, *P* = 0.109). For five multi-item functional scales (physical, emotional, role, cognitive and social function), three multi-item and six single-item symptom scores, it showed no significant difference between these two groups (Figure 1 and Table 3).

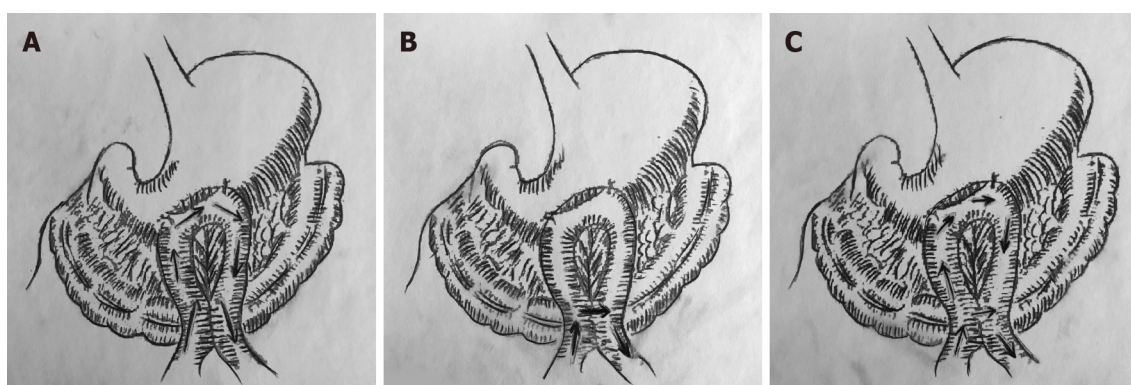
DISCUSSION

Billroth II reconstruction was invented in 1885 by Billroth as a modification of Billroth I. Due to the unique structure of Billroth II reconstruction, bile will flow through the residual stomach to the afferent loop, causing reflux gastritis (Figure 2A). Billroth II reconstruction is recognized with complications including anorexia, loss of appetite, dumping syndrome, nutritional anemia and alkaline reflux esophagitis[19]. In a previous study, the addition of Braun anastomosis was regarded as a method to



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Figure 1 Serious reflux gastritis after operation.



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Figure 2 Billroth II reconstruction combined with Braun anastomosis. A: Reflux gastritis; B: Supposed bile flow; C: Possible bile flow.

reduce the incidence of reflux gastritis. That is because Braun anastomosis could relieve the afferent loop pressure[20,21], making bile flow through the jejunum- jejunum anastomosis, rather than the residual stomach (Figure 2B).

In this study, the incidence of reflux gastritis in Group 1 was lower than that in Group 2, but the difference was insignificant. It is indicated that bile may flow through both the residual stomach and the jejunum- jejunum anastomosis (Figure 2C). More experiments are needed to ensure this judgement.

In terms of postoperation complications, Group 1 and Group 2 were similar. The five multi-item functional scales (physical, emotional, role, cognitive and social function), three multi-item and six single-item symptom scores showed no significant difference as well.

CONCLUSION

In conclusion, this study indicated that the addition of Braun anastomosis to Billroth II reconstruction made no significant difference in reducing the incidence of reflux gastritis. The addition can hardly improve the quality of life of the patients but extends the operation time. Thus, the addition of Braun anastomosis is not necessary, and simple Billroth II reconstruction should be widely applied.

ARTICLE HIGHLIGHTS

Research background

Braun anastomosis is usually performed after Billroth II reconstruction on laparoscopy-assisted distal gastrectomy because it is believed to benefit patients. But we found that patients who underwent Braun anastomosis still had serious complications after operation. Thus, studies are needed to confirm that.

Research motivation

To determine whether the addition of Braun anastomosis to Billroth II reconstruction on laparoscopy-

assisted distal gastrectomy benefits patients.

Research objectives

To study the role of Braun anastomosis in laparoscopy-assisted distal gastrectomy.

Research methods

The clinical data of the addition of Braun anastomosis to Billroth II reconstruction on laparoscopy-assisted distal gastrectomy for patients with distal gastric cancer were compared. Patient follow-up data were analyzed. Operation time, blood loss, anal exhaust time and prevalence rate of reflux gastritis between the groups were examined.

Research results

Postoperative complications were reported in 3 of the 33 patients in the Billroth II reconstruction group and 4 out of 60 patients in the Billroth II reconstruction combined with Braun anastomosis group. The total incidence of postoperative complications indicated no significant difference between the two groups. During follow-up, 11 patients in the Billroth II reconstruction group and 29 patients in the Billroth II reconstruction combined with Braun anastomosis group had reflux gastritis. The total incidence of reflux gastritis showed no significant difference (66.7% *vs* 51.7%, $P = 0.109$). Five multi-item functional scales (physical, emotional, role, cognitive and social function), three multi-item and six single-item symptom scores showed no significant difference between these two groups.

Research conclusions

The addition of Braun anastomosis to Billroth II reconstruction on laparoscopy-assisted distal gastrectomy did not show any benefit to patients with distal gastrectomy.

Research perspectives

A prospective study with more patients is required to verify the conclusions of this study.

FOOTNOTES

Author contributions: Li XG designed the experiment; Song QY and Wu D performed the experiment; Li S and Zhang BL collected data; Zhang LY and Guan D managed data; Liu L created the tables and figures based on data; Li XG, Song QY and Wu D wrote the initial draft; Wang XX modified the draft; Li XG, Song QY and Wu D contributed equally to this article.

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