Observational Study

Medicine

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A comparative study of using linear anastomosis with circular anastomosis in digestive tract reconstruction after laparoscopic radical total gastrectomy

A retrospective study

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Abstract

The purpose of this study is to compare the incidence of anastomotic leakage or stenosis, anastomotic bleeding, anastomosis time, postoperative exhaust time, pneumonia, gastroesophageal reflux, hospitalization and mental state after laparoscopic radical gastrectomy, so as to provide a reliable basis for the safety selection of the 2 clinical anastomosis methods and postoperative care. This study retrospectively analyzed the clinical data of 160 gastric cancer patients treated by our medical team from February 2021 to December 2021. We divided them into side-to-side anastomosis with linear stapler (linear stapler) and end-to-side anastomosis with circular stapler (circular stapler), analyzed the incidence and clinical efficacy of anastomotic complications after laparoscopic radical total gastrectomy. There was a statistically significant difference between linear stapler and the circular stapler in the incidence of anastomotic complications such as the incidence of anastomotic stenosis; The incidence of anastomotic leakage, incidence of anastomotic bleeding, without statistical significant; At the anastomosis time, time of first postoperative discharge, incidence of pneumonia, length of hospital stay, without statistical significant; The incidence of gastroesophageal reflux without statistical significant; The Anxiety Self-rating Scale score, depression self-rating scale score points, the linear stapler was significantly lower than the postoperative circular stapler. The study showed that the anastomotic complications (absolute odds ratio of 1.08; 95% CI 1.02–1.15). This 2 protocol can be used safely and effectively common methods for gastric cancer. The linear stapler after laparoscopic radical total gastrectomy was better than the circular stapler, and was better than the circular stapler in terms of postoperative exhaust time, the incidence of pneumonia and the hospital time. However, the anastomosis time was longer than that of the circular stapler, and fees are also relatively expensive.

Abbreviations: SAS = self-rating scale, SDS = self-evaluation scale.

Keywords: anastomotic complications, circular stapler, laparoscopic radical total gastrectomy, linear stapler, psychological state

1. Introduction

Gastric cancer occupies the fourth position in global malignant tumor incidence and the second position in mortality.[1] Traditional open radical surgery is the most fundamental treatment for early and advanced gastric cancer. After years of development, laparoscopic surgery is becoming more and more diversified, and now it has become a common surgical[2] for radical resection of gastric cancer. The use of laparoscopic radical gastrectomy in early gastric cancer has become increasingly mature, and compared with open total gastrectomy, laparoscopic total gastrectomy has been proved to be a safe and effective.[3] With the increasing incidence of proximal gastric cancer in the past decades, laparoscopic total gastrectomy has become the preferred treatment option.[4] However, its safety and feasibility have not been proven, as the laparoscopic surgical technique also remains challenging for trained surgeons. Literature reports on the efficacy of the outcome after total laparoscopy for early and advanced gastric cancer are still scarce. Moreover, the current literature on the choice of gastrointestinal anastomosis method after laparoscopic radical distal gastrectomy is still controversial, what's more choosing which

The study was supported by General Program of Shandong Natural Science Foundation (ZR2019MH080).

The authors have no conflicts of interest to disclose.

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

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How to cite this article: Huang H, Guo Z, Li W, Zhang M, Li Y. A comparative study of using linear anastomosis with circular anastomosis in digestive tract reconstruction after laparoscopic radical total gastrectomy: A retrospective study. Medicine 2023;102:35(e34588).

Received: 26 March 2023 / Received in final form: 6 July 2023 / Accepted: 13 July 2023

http://dx.doi.org/10.1097/MD.0000000000034588

anastomosis method that can effectively reduce post-gastrectomy complications remains unclear. Therefore, this study used a retrospective study, analyzed the clinical data of 160 gastric cancer patients treated surgically by our medical team between February 2021 and December 2021, comparatively analyzed of the short-term effect of esophageal-jejunal digestive tract reconstruction using a linear cutter anastomosis or a circular stapler after laparoscopic radical total gastrectomy, to explore the feasibility and clinical efficacy of the way of digestive tract reconstruction and anastomosis in laparoscopic technology.

2. Materials and methods

The clinical data of 160 patients with early and advanced gastric cancer who underwent laparoscopic radical total gastrectomy conducted by the same treatment team in our hospital from February 2021 to December 2021 were collected. According to the anastomosis selected during the operation, the patients were divided into 2 groups: the linear stapler (n = 80) group and the circular stapler (n = 80) group. No gastrointestinal decompression was performed in all patients after operation. Different gastrointestinal anastomosis methods were selected according to the location of the tumor. Patients whose tumor was located in the upper part of the gastric body or the fundus of the stomach without out involving the cardia were selected for total endoscopic esophagojejunostomy with the linear side-to-side anastomasis. In order to ensure that the surgical margin was negative, laparoscopic assisted surgery was selected for end-to-side esophagojejunostomy under direct vision. The study was approved by The Ethics Committee of Binzhou Medical University Hospital (No. KT-007). The data were anonymous, and thus no informed consent was required.

2.1. Exclusion criteria

① Multiple organ resection or conversion from laparoscopic surgery to open method;
② Neoadjuvant chemotherapy or immunotherapy before operation;
③ Re-operation due to tumor recurrence or residual gastric cancer;
④ Tumors with clinical stage IV.

2.2. Surgical method

Patients undergoing laparoscopic surgery have their legs apart in supine position, with carrying the endoscope, the doctor stand between the patients' legs. Meanwhile, the surgeon stands on the left side of the patient and the right side of the patient is the first assistant. The surgeon position is adjusted according to the operation area. After laparoscopic dissection and lymph node dissection, the surgeon performs specimen resection and esophagojejunal anastomosis reconstruction. The reconstruction method is to select the side-to-side anastomosis with the linear cutting stapler under the total endoscope, and then take out the specimen at the midline incision of the upper abdomen about 3 to 4 cm, as shown in Figure 1, or take out the specimen at an incision of 7 to 10 cm in the midline of upper abdomen, and then perform end-to-side anastomosis with circular stapler under direct vision, as shown in Figure 2.

2.3. Observation indicators

Observe and record the following indicators: postoperative anastomotic leakage, anastomotic stenosis, bleeding, and anastomosis time, postoperative exhaust time, pneumonia and gastroesophageal reflux symptoms, hospital stay. Anxiety self-rating scale (SAS), 20 items, 4 points, 1.25 times of the total score, the upper normal limit of the total score is 40 points and the standard score is 50 points. If the standard score is less than 50 points, it indicates normal psychological condition, and over 50 points, anxiety symptoms. The higher the score, the more serious the anxiety symptoms; If the depression self-evaluation scale (SDS) is used, 1.25 times of the total score is the standard score, and the cutoff value of depression assessment is 50 points. The standard score is less than 50 points, indicating that the psychological condition is normal, and 50 points above the standard score indicates that there are depressive symptoms. Higher scores indicate more severe depressive symptoms.

2.4. Statistical analysis

Data analysis was conducted by SPSS 25.0 software, normally distributed measurement data were expressed as mean ± standard deviation (x ± s), measurement data were expressed by t test, count data were expressed as [n (%)], χ^2 test and Fisher's exact probability method, $P < .05$ was statistically significant.

3. Results

3.1. Patient clinical data

There was no significant difference in gender, age and tumor pathological stage between the 2 staplers ($P > .05$), as shown in Table 1.

3.2. Postoperative indexes

According to the statistical results, in the 2 patient staplers, linear stapler, as compared to the circular stapler had no significant difference in the incidence of anastomotic leakage and the incidence of anastomotic bleeding, ($P > .05$). The incidence of anastomotic stenosis in the linear stapler is lower than that in the circular stapler, ($P < .05$). The anastomotic complications (Absolute Odds Ratio of 1.08; 95% CI: 1.02–1.15). The average time required for the straight cutting side-to-side anastomosis stapler (66.83 ± 9.791 minutes) was significantly different from the average time required for the circular stapler (54.86 ± 8.823 minutes). The linear side-to-side stapler has a long anastomosis time, ($P < .05$). The incidence of gastroesophageal reflux was not statistically significant in both staplers, ($P > .05$). The time of the first postoperative exhaust in the straight cut side-to-side anastomosis stapler (2.69 ± 0.894 minutes) was significantly different from that in the circular stapler (3.96 ± 1.061 minutes), Short postoperative first exhaust time in the linear side-to-side stapler, ($P < .05$). Low incidence of pneumonia in linear stapler, ($P < .05$). There was no obvious difference in the incidence of gastroesophageal reflux. The length of postoperative stay in linear stapler (6.53 ± 0.914 minutes) was significantly different from that in the circular stapler (8.64 ± 1.058 minutes), Short postoperative hospital stay in the linear side-to-side stapler, ($P < .05$). The score of anxiety SAS of linear side-to-side anastomosis stapler was (48.70 ± 7), and self-rating scale of depression (SDS) was (46.61 ± 6). It was significantly lower than that in the circular stapler ($P < .05$). As shown in Tables 2 and 3.

4. Discussion

At present, the most effective treatment for gastric cancer is surgical resection, both kinds of surgery open radical total gastrectomy and laparoscopic surgery, currently have high success rate and safety. But compared with open surgery, laparoscopic total gastrectomy may lead to the increase of postoperative complications, the most common such as anastomotic fistula, anastomotic stenosis.[5] With the development of science and technology, the medical level is also constantly improving. In order to reduce the incidence of common postoperative complications, the

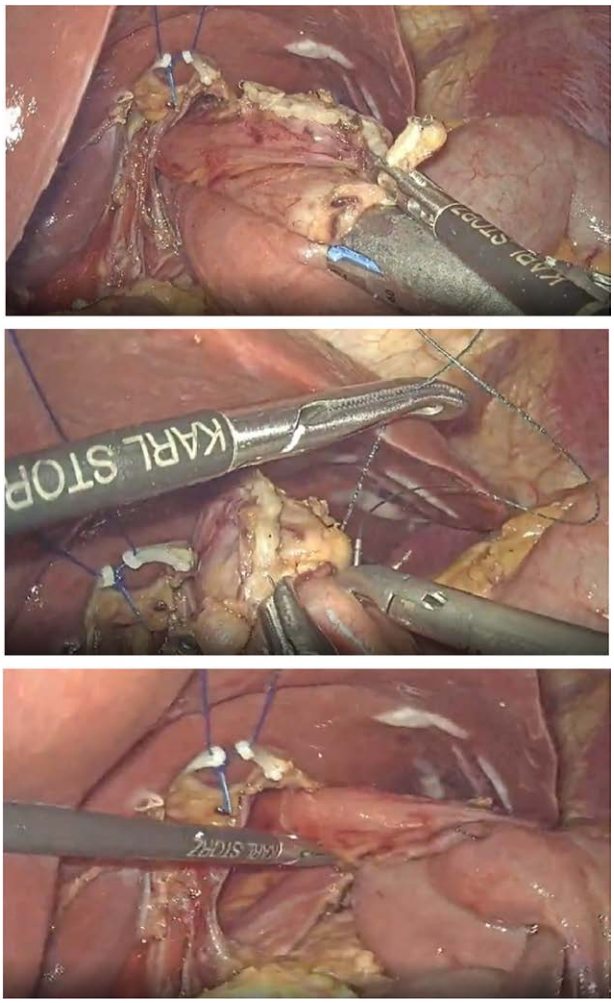

Figure 1. Selection of reconstruction method: side-to-side anastomosis with linear cutting stapler under total endoscope.

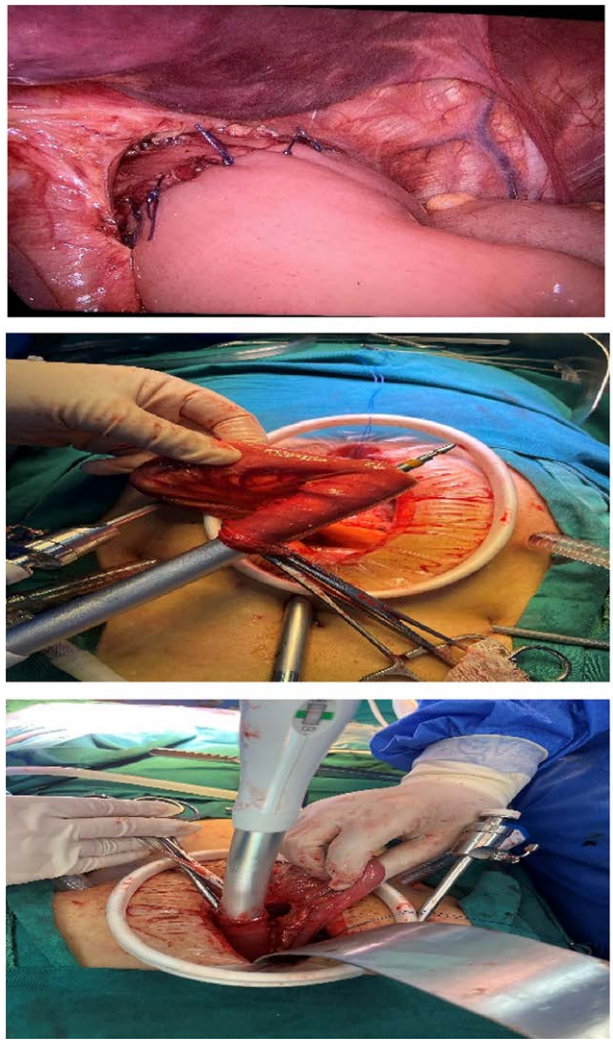

Figure 2. Selection of reconstruction method: end-to-side esophagojejunostomy with circular stapler under direct vision.

laparoscopic surgery method is also constantly changing and improving.[6] Of the 160 patients who underwent esophageal-jejunostomy, one had anastomotic fistula. Among them, patients diagnosed as esophagogastric anastomotic microleakage by oral meglumine diatrizoate imaging examination were cured after gastroscopic treatment, thoracic puncture drainage and enteral nutrition treatment. It is not very important to consider the complications of anastomotic fistula and choose which method to choose, but are positively correlated with the surgeon's endoscopic surgery level and careful degree of positive correlation, for example in free distal esophagus anastomosis, high anatomy in the mediastinum may mistakenly break the blood vessels around the esophagus, which will make the distal esophagus part lose the blood supply, and even cause the problem of anastomotic leakage and bleeding. Therefore, when choosing the anastomosis mode of radical total gastrectomy under total endoscope, if the anastomosis is not ideal during the operation, it is suggested that the suture should strengthen the anastomosis and leave the drainage tube near the anastomosis routinely. Imaging examination was performed before the drainage tube was removed after operation.

Astomotic stenosis is another common complication in patients after laparoscopic total gastrectomy. In this study, anastomotic stenosis occurred in 6 out of 160 patients. It was found that the anastomosis stenosis rate of the linear stapler was significantly lower than that of the circular stapler. Firstly, this may be related to fact that linear stapler. This anastomosis eliminates the problem that esophageal stricture or circular anastomosis usually requires reinforcement and suture. Umemura[7] found a higher incidence of stenosis after esophagojejunal anastomosis than after linear stapler, and the incidence of stenosis after esophageal-jejunal anastomosis using linear anastomosis was only 1.8%. Because there are few relevant literature reports, we still need further data research to fully understand and solve this problem.

With advances in laparoscopic techniques, there is no substantial difference in feasibility or safety between the 2 anastomosis methods. However, in this study comparing linear side-to-side anastomosis with circular anastomosis, we found the study showed that the anastomotic complications (Absolute Odds Ratio of 1.08; 95% CI 1.02–1.15). The linear side to side anastomosis and circular stapler schemes used in these patients are still relatively excellent. This 2 protocol can be used safely and effectively common methods for gastric cancer. But we preferred to choose linear, which has several advantages compared with circular anastomosis. Firstly, it will produce a significantly wider anastomosis and can relatively reduce the complications of anastomotic stenosis. Secondly, it has obvious advantages over the circular stapler in terms of the first postoperative exhaust time, incidence of pneumonia, hospital stay, and psychological status. In this study, we can clearly observe that the time of the first postoperative exhaust in the linear anastomosis

Table 1

Comparison of clinical data between the 2 staplers ($\bar{x}$ ± s).

	Age distribution (n)		Gender (n)		Pathological stage (n)		
Stapler	**≤60 yr old**	**>60 yr old**	**Male**	**Female**	**I designated time**	**II designated time**	**III designated time**
linear stapler	21	59	49	31	9	18	53
Circular stapler	22	58	46	34	11	26	43
t price	0.0032		0.233		2.696		
P price	.858		.629		.26		

Table 2

Comparison of the 2 staplers ($\bar{x}$ ± s).

	Astomotic stenosis (n)		Anastomotic leakage (n)		Astomotic bleeding (n)	
Stapler	**Have**	**None**	**Have**	**None**	**Have**	**None**
linear stapler	0	80	1	79	1	79
Circular stapler	6	74	0	80	0	80
χ^2						
P price	.014		.5		.5	

Table 3

Comparison of postoperative indexes between the 2 staplers ($\bar{x}$ ± s).

			Pneumonia occurrence (n)		Gastroesophageal reflux (n)			
Stapler	**Stapler stapling time (d)**	**Postoperative exhaust time (d)**	**Have**	**None**	**Have**	**None**	**SAS score (points)**	**SDS score (points)**
Linear stapler	66.83 ± 9.791	2.69 ± 0.894	9	71	8	72	48.70 ± 7.613	46.61 ± 6.59
Circular stapler	54.86 ± 8.823	3.96 ± 1.061	19	61	6	74	52.49 ± 8.138	53.08 ± 6.35
t/χ^2	8.118	−8.219	4.329		0.313		−3.04	−6.316
P price	<.0001	<.0001	.037		.576		.003	<.0001

SAS = self-rating scale, SDS = self-evaluation scale.

group is significantly earlier, which may be related to the smaller abdominal wall incision, the patient can endure pain and get out of bed earlier, and can effectively promote gastrointestinal peristalsis and accelerate the recovery of gastrointestinal function. This article also found that some patients have symptoms of gastroesophageal reflux, which may be related to the fact that gastrointestinal decompression is not performed, the digestive fluid stimulates the intestinal peristalsis to increase, and some patients are intolerant, resulting in reflux symptoms. In terms of the occurrence of pneumonia, because the patients in linear stapler got out of bed early, which promoted the discharge of sputum and avoided long-term bed rest, the probability of pneumonia was significantly less than that in the circular stapler, and we also found that the hospital length of stay in linear stapler was significantly earlier. This is also in line with the concept of accelerating rehabilitation surgery (ERAS) to reduce psychological and physical trauma stress response, postoperative complications, length of stay, incidence of death and medical costs. Linear stapler method not only accelerates the postoperative recovery time of patients, but also reduces the psychological burden and physical pressure of patients. However, we also found that in laparoscopic surgery, the anastomosis time is better than linear stapler, which may better control the overall operation and anesthesia time and avoid the damage to the patient with the long anesthesia time. This paper also found that the SAS and SDS scores of the linear stapler were significantly decreased compared with the circular stapler, which may be related to the size of the surgical incision, pain, ambulation and other factors, which made the patients had negative emotions, and then the psychological state of anxiety and depression. In the ERAS concept, especially after surgery, reducing the psychological burden and physical stress of patients is an important link. Maintaining a good mental state can not only improve the quality of life, but also promote the prognosis of a better patient. Good mood makes the patient's compliance with medical treatment significantly improved, reduces the patient's physical and mental stimulation, which is conducive to the early postoperative implantation activities, promote gastrointestinal peristalsis and restore gastrointestinal function. Although more and more laparoscopic surgeries are carried out, there are still great controversies in the prognosis of long-term survival. Besides, it is regarded as a high-risk surgery by domestic experts, and postoperative complications should be considered while paying attention to the safety of surgery. Laparoscopic total gastrectomy is a complex and delicate operation, and we need to increase the scale of the comparative study and patient survival prognosis to provide a reliable basis for the best choice of the 2 anastomosis methods.

5. Conclusion

The side-to-side anastomosis stapler after laparoscopic radical total gastrectomy was better than the circular stapler in terms of anastomotic complications such as anastomotic stenosis, better than the circular stapler in terms of postoperative exhaust time, the incidence of pneumonia, and

hospitalization time, and it could effectively alleviate the adverse mood of patients. However, the anastomosis time was longer than that of the circular stapler anastomosis stapler, and the hospitalization cost was higher than that of the circular stapler.

Author contributions

Conceptualization: Hai Huang, Yanbin Li.
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Formal analysis: Wen Li.
Funding acquisition: Yanbin Li.
Investigation: Hai Huang.
Methodology: Hai Huang.
Project administration: Yanbin Li.
Resources: Yanbin Li.
Software: Zhiyuan Guo.
Supervision: Mingkai Zhang.
Validation: Hai Huang, Zhiyuan Guo, Mingkai Zhang, Yanbin Li.
Writing – original draft: Hai Huang.
Writing – review & editing: Yanbin Li.

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