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Application Value of Overlap Anastomosis and Common Opening Closure Method in Gastric Cancer Surgery and Key Points for Complications Prevention

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Abstract: Laparoscopic radical gastrectomy is the main clinical treatment for gastric cancer. In the surgery, digestive tract reconstruction is an important part, and esophago–jejunal anastomosis is a key step in reconstructing the digestive tract, often using the overlap anastomosis method. This anastomosis technique can reduce the tension of the anastomotic stoma and, to a certain extent, lower the risk of anastomosis related complications. In the overlap anastomosis surgery, how to close the common opening is related to the postoperative complications of patients. This article mainly introduces and analyzes the overlap anastomosis surgery and the common opening closure method for gastric cancer patients, and elaborates on the key points for preventing relevant complications after overlap anastomosis surgery.

Keywords: Gastric cancer; Laparoscopic radical gastrectomy; Overlap anastomosis; Common opening closure method; Complications

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1. Introduction

Gastric cancer, a common malignant tumor of the digestive tract, has a high prevalence and mortality rate, posing a serious threat to human life. For patients with gastric cancer who meet the indications for surgical resection, radical resection is recommended. With the gradual improvement of laparoscopic techniques, laparoscopic radical gastrectomy has become a commonly used surgical approach, achieving both minimally invasive and effective surgical treatment for gastric cancer.

In laparoscopic surgery, proper esophago–jejunal anastomosis is crucial. Selecting an appropriate esophago–jejunal anastomosis method is the key to ensuring successful digestive tract reconstruction and can also reduce the risk of postoperative complications. One such method is the Overlap anastomosis [1]. The team from Shanxi Hospital of the Cancer Hospital, Chinese Academy of Medical Sciences, proposed an improvement in the closure method of the common opening during the Overlap anastomosis for gastric cancer, suggesting that the improved closure method can reduce anastomosis related postoperative complications [2].

Currently, there are very few studies on this aspect, and there is a lack of sufficient clinical data. In this paper, we

first elaborate on the application of the Overlap anastomosis method in gastric cancer surgery by citing recent literature. Then, starting from the closure method of the common opening in Overlap anastomosis and combined with peri–operative management, we analyze the key points for preventing anastomosis–related complications after gastric cancer surgery. The review is presented as follows.

2. Application of overlap anastomosis in gastric cancer surgery

Previously, in laparoscopic radical gastrectomy, the π shaped anastomosis was a common method for esophago–jejunal anastomosis. However, this method had a small operating space during esophago–jejunal anastomosis, which led to a longer time for the anastomosis, prolonging the overall operation time, and was prone to anastomotic bleeding after surgery.

The overlap anastomosis technique was first applied in digestive tract reconstruction during total gastrectomy. After continuous improvement in clinical practice, this technique has gradually been extended from total gastrectomy to other gastric cancer surgeries. The overlap anastomosis method advocates removing the specimen before anastomosis, which can expand the limited operating space, save the time for anastomosis and the overall operation, and simplify the surgical procedure.

After separating the esophagus and jejunum, the common opening can be closed simultaneously, reducing the irritation to the patient's body. Moreover, during the anastomosis process, there is no need to consider the diameters of the esophagus and small intestine, nor to fold the jejunum and its mesentery, ensuring a large anastomotic opening and avoiding postoperative anastomotic stenosis. After overlap anastomosis, the peristalsis of the esophagus and jejunum is antegrade peristalsis. The antegrade side to side anastomosis is the core principle of the overlap anastomosis technique, which reflects the respect and protection of the physiological function of the digestive tract, enabling the reconstructed digestive tract function to conform to the normal physiological function of the human digestive tract as much as possible and promoting the recovery of the patient's digestive tract function after surgery.

In recent years, there have been more clinical reports on the application of the overlap anastomosis technique in gastric cancer surgery. For example, Yuan Chenglong et al. applied the modified overlap anastomosis technique in 3D total laparoscopic radical gastrectomy for gastric cancer [3]. Compared with patients using the π shaped anastomosis method, they found that the modified overlap anastomosis technique was more advantageous in shortening the operation time and reducing surgical trauma. Wu Chuying et al. used circular staplers and the overlap anastomosis technique respectively for digestive tract reconstruction in gastric cancer patients [4]. The results showed that the modified overlap anastomosis technique could reduce the surgical incision of patients undergoing laparoscopic total gastrectomy and accelerate the postoperative recovery. Peng Shilong et al. compared the overlap anastomosis technique with the Billroth I anastomosis technique [5]. The results showed that compared with the Billroth I anastomosis technique, the anastomosis time and the length of the abdominal incision in the overlap anastomosis group were shorter. Guan Jiajia et al. believed that applying the overlap anastomosis technique in totally laparoscopic radical gastrectomy could effectively reconstruct the digestive tract, reduce the occurrence of complications, and improve the quality of life [6]. All the above studies have confirmed the effectiveness of the overlap anastomosis technique in gastric cancer surgery.

Compared with traditional anastomosis methods, the overlap anastomosis technique has several significant advantages. Firstly, the anastomotic stoma created by this technique offers a high level of safety. During anastomosis, a linear cutting stapler is mainly used, which is equipped with a three layer suture system. This system can ensure better hemostasis at the anastomotic site. Moreover, during the *in vivo* anastomosis process, before closing the common entry hole, the luminal side of the esophago–jejunal anastomotic stoma can be inspected, allowing for the timely detection and management of anastomotic bleeding. Secondly, it has strong operational adaptability. The linear cutting stapler is thinner than the circular stapler. In laparoscopic radical gastrectomy, the surgical field is usually deep and narrow. The linear cutting stapler has better mobility, making the operation easier. It also helps avoid the torsion of the jejunal loop and the

involvement of other organs, thereby reducing anastomosis related complications. Additionally, when using the linear cutting stapler for anastomosis, there is no restriction on the esophageal caliber, and it can create a larger anastomotic caliber than the circular stapler. Thirdly, this anastomosis technique has a low incidence of complications. This is mainly due to its antegrade peristalsis design and the larger anastomotic caliber, which effectively reduce the occurrence of postoperative anastomotic stenosis. Furthermore, in terms of adaptability to special anatomical conditions, the overlap anastomosis technique has an edge. By reducing the tension of the anastomotic stoma, it can achieve lower mesenteric tension, appropriately raise the position of the anastomotic stoma, and obtain better anastomotic results. Especially for patients with a high esophageal transection position, this technique has unique advantages. It does not require excessive mobilization of the jejunum, nor does it increase the operational difficulty due to the high position of the anastomotic stoma [7].

3. Prevention of complications after overlap anastomosis for gastric cancer surgery

3.1. Preoperative management

Preoperative assessment and preparation serve as the first line of defense in preventing anastomosis related complications after overlap anastomosis surgery. A comprehensive assessment from multiple dimensions is required, as detailed below:

(1) Assessment of the patient's general condition

Evaluating the general condition is the foundation of preoperative assessment, encompassing aspects such as nutritional status, organ function, and comorbidities. Malnutrition is a crucial factor leading to poor healing of the anastomotic stoma after surgery. Therefore, special attention should be paid to assessing the patient's nutritional status before the operation.

(2) Assessment of surgical tolerance

A comprehensive evaluation of the patient's organ function is necessary to rule out surgical contraindications. Especially for elderly patients and those with multiple comorbidities, cardiopulmonary function assessment and coagulation function tests should be conducted.

(3) Oncological assessment

Before performing radical gastrectomy, the progression of the patient's tumor needs to be evaluated. Through means such as imaging examinations and endoscopic examinations, the location, size, depth of invasion, and lymph node metastasis of the tumor should be clarified to determine the surgical plan and prepare for prognosis assessment.

(4) Assessment of technical feasibility

Before the operation, the anatomical characteristics of the surgical site and the surgical difficulty should be considered. Particularly for patients with a short esophagus, obesity, or a history of previous abdominal surgeries, the feasibility of the overlap anastomosis technique needs to be evaluated [8].

In addition to preoperative assessment, it is of great importance to carry out preoperative preparation work, which includes several aspects. Firstly, bowel preparation is essential. Standardized bowel preparation should be carried out before the operation to ensure the evacuation of bowel contents, thereby reducing the risk of abdominal and anastomotic stoma infections. Secondly, prophylactic use of antibiotics is necessary. Whether to use prophylactic antibiotics can be determined based on the results of the patient's preoperative assessment. Prophylactic use of antibiotics is an important measure to reduce postoperative infections. Thirdly, nutritional support is required. Patients at risk of malnutrition should be given special attention. If necessary, enteral or parenteral nutritional support can be provided before the operation to correct their malnutrition.

3.2. Intraoperative management

Standardized intraoperative operation is a crucial step in preventing complications after overlap anastomosis. Therefore,

during the surgery, medical staff must strictly follow the standardized operation process. Tissue protection technology is the core of intraoperative operations, which includes protecting tissue blood supply and avoiding excessive traction. During the dissection of the esophagus, jejunum, or stomach, the mesentery should be fully dissected to reduce the tension of the anastomotic stoma, and attention should also be paid to protecting the supplying blood vessels to avoid vascular injury. During the anastomosis process, team cooperation should be emphasized, and delicate operations should be carried out to avoid accidental injuries that may lead to ischemia.

The key points of the anastomosis technique include several crucial steps. First, the esophagus is processed. On the premise of ensuring the safety of the tumor resection margin (the distance from the tumor to the proximal resection margin is ≥ 3 cm), the esophagus is transected from left to right, leaving a width of 5–8 mm. The specimen is then placed in a specimen bag and moved to the right middle abdomen. The patient's position is adjusted, and the abdominal esophagus is fully tractioned by the gravity of the specimen. Second, the stapler is inserted. The esophageal lumen is exposed using the "three way traction" gastric tube guiding method, and the anvil of the stapler is accurately inserted to complete the side to side esophago–jejunal anastomosis. Moreover, using the gastric tube for guidance, suturing the full thickness of the anterior esophageal wall with sutures or fixing the full thickness of the anterior esophageal wall with titanium clips before anastomosis can effectively expose the esophageal lumen [9].

The technique of closing the common opening is both a difficult and important part of the intraoperative operation and an important direction for improving the overlap anastomosis technique. The traditional closing methods have limitations such as the double barbed suture not forming an interval between the double suture needle distances, and the large spacing is prone to causing anastomotic leakage. The key points of the improved closing method include closing the common opening with a barbed suture in full thickness, and then reinforcing the anastomotic stoma with a barbed suture at the seromuscular layer. During the suturing process, the lateral angles of the two esophageal stumps are included in the suture, and one suture is placed above the esophago–jejunal anastomosis to relieve the tension of the esophago–jejunal anastomosis. However, there are few research reports on this aspect. Zhu Xiaofeng et al. compared the seromuscular layer suture method for closing the common opening with the linear cutting closure method [10]. The results showed that the seromuscular layer suture method could reduce the bleeding volume during anastomosis and the overall operation time. Zhu Akau et al. used a knotless absorbable barbed suture to close the common opening [11]. Based on the research results, they concluded that this closing method was simple and feasible. The team of Shanxi Hospital of the Chinese Academy of Medical Sciences Cancer Hospital, composed of Zhang Wanhong et al., closed the common opening of the overlap anastomosis in an improved way, and none of the patients had anastomotic leakage after the operation [2]. Wang Huashe et al. used the double barbed suture improved mattress invagination suture technique to close the common opening, which effectively shortened the operation time and allowed the patients to recover faster after the operation [12].

3.3. Postoperative management

Postoperative management serves as the last line of defense for preventing anastomosis-related complications after overlap anastomosis surgery, covering three main aspects.

Firstly, postoperative monitoring includes the basic monitoring of vital signs such as body temperature, blood pressure, heart rate, and respiration. Abnormal changes in these vital signs are often precursors of postoperative complications. The drainage situation of the drainage tube, including the color, volume, and nature of the drainage fluid, should be observed. Abnormal conditions may indicate the possibility of anastomotic leakage or bleeding. Specialized monitoring for anastomotic leakage and bleeding is also necessary. For anastomotic leakage, symptoms like fever, abdominal pain, and dyspnea should be closely watched, and inflammatory indicators such as blood routine and C-reactive protein should be regularly rechecked, with upper gastrointestinal angiography performed when necessary. For anastomotic bleeding, manifestations such as hematemesis, melena, and a drop in blood pressure should be observed, and hemoglobin should be regularly monitored.

Secondly, infection prevention involves the rational use of antibiotics. The administration of antibiotics should be

determined by factors such as the duration of the surgery, intraoperative conditions, and the patient's basic condition. Additionally, the surgical incision should be kept clean and dry, and dressing changes should be carried out on time. Nutritional support plays a significant role in promoting the healing of the anastomosis.

Lastly, postoperative nutritional intervention is essential. In the early postoperative period, due to the unrecovered gastrointestinal function, the patient has limited ability to absorb nutrients, while having a high demand for nutrition and rapid energy consumption. Therefore, nutritional intervention is required to facilitate recovery. In the early stage, nutrient solutions can be intravenously infused to provide sufficient energy and nutrition. Once the gastrointestinal function recovers, the diet can gradually transition from liquid food to semi-liquid food and then to a normal diet.

4. Conclusion and prospects

In laparoscopic radical gastrectomy, the application of the overlap anastomosis technique has significant clinical advantages. With the design of antegrade peristaltic lateral anastomosis, it can reduce the tension of the anastomotic stoma and enable a higher-level esophageal resection within the limited operating space. After the surgery, to prevent complications, it is necessary to construct a preventive strategy covering the entire process of pre operation, intra operation, and post operation. Among them, the improvement of the closure method of the common opening is the key point for preventing complications. In the future, more in depth research on the gastric cancer overlap anastomosis technique and the closure method of the common opening is needed to continuously improve and refine the technique and achieve more efficient and safer treatment.

Disclosure statement

The authors declare no conflict of interest.

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