

Application of Vagus Nerve Anatomy of Stomach in Clinical Surgical Resection

Wei Huang

Kunming Medical University Haiyuan College, Kunming, Yunnan, 650000, China

Keywords: Vagus Nerve, Gastric Cancer, Anatomy, Operation

Abstract: objective: to observe, measure and analyze the application of gastric vagus nerve anatomy in clinical surgical resection. Methods: 60 patients with gastric cancer were selected and all underwent electronic gastroscopy before operation and were diagnosed with clinical symptoms and signs. Sixty patients were randomly divided into study group (n = 22) and control group (n = 30), and study group (n = 8). The control group was treated with traditional radical gastrectomy and lymph node dissection. The study group underwent radical gastrectomy with vagus nerve preservation. The anesthesia method was tracheal intubation anesthesia. The distribution and number of parietal cells were observed. Five visual fields were counted for each section, and the average value of the sections in the same part was taken. Finally, the comprehensive analysis was carried out with hsv. Results: there was no significant difference in operation time and bleeding volume between the study group and the control group ($p > 0.05$). After 6 months of follow-up, the incidence of postoperative complications in the study group was 24.52%, while that in the control group was 47.66%. The difference between the two groups was statistically significant ($p < 0.05$). Conclusion: vagus nerve preservation radical gastrectomy is safe and feasible, which can significantly reduce the occurrence of postoperative complications, improve the quality of life of patients, and is ideal for the treatment of gastric cancer.

1. Introduction

In recent years, the use of highly selective gastric vagotomy for the treatment of gastroduodenal ulcer is increasing. The success or failure of the operation is closely related to the understanding of the distribution of gastric vagus nerve branches. In theory, highly selective vagotomy (hsv) is better than selective vagotomy, but the postoperative effect is still not ideal. The acid reduction rate is only about 80 intestines, and the recurrence rate is 8%-10%[1]. The main reason is incomplete vagotomy, especially the lack of proper treatment of gastric vagus nerve fibers on the greater curvature side. Therefore, a full understanding of the anatomy of the posterior trunk of vagus nerve and its branches plays an important role in improving the surgeon's understanding of the selection of surgical approaches and procedures [2]. The anatomy of the posterior trunk of vagus nerve in textbooks and literatures mostly comes from autopsy, and the classification and data of vivisection obtained during operation are very few, especially the anatomy of laparoscopic surgery has not been reported in literatures. The branches of gastric vagus nerve were dissected to observe their branches and anatomical relationship with surrounding structures. Video-assisted thoracoscopic dissection of gastric vagus nerve and its branches in dogs was applied to accurately cut off gastric vagus nerve branches, reduce collateral damage and improve surgical efficacy.

2. Data and Methods

2.1 General Information

60 cases of gastric cancer were selected, all of them were examined by electronic gastroscope before operation and diagnosed with clinical symptoms and signs. 60 patients were randomly divided into study group and control group, 30 cases in each group, 22 men and 8 women in the study group, with an average age of (56.2 ± 2.5) years; tumor site: 17 cases in the middle and lower part of gastric body, 13 cases in the pyloric part of gastric antrum; 20 men and 10 women in the control group, with an average age of (56.9 ± 2.8) years; Tumor location: 18 cases in the middle and

lower part of gastric body, 12 cases in the pylorus part of gastric antrum. There was no significant difference in age, gender and tumor distribution between the two groups ($P > 0.05$). Inclusion criteria: upper and middle gastric cancer cT1N0M0 or lower gastric cancer CT1 ~ 2N0M0. Exclusion criteria: preoperative imaging examination and intraoperative exploration of lymph node enlargement and suspicious metastasis; Anatomy of vagus nerve and left gastric artery is unclear due to obesity, bleeding and other factors during operation. Prior to the operation, informed consent was signed.

2.2 Method

The control group was treated with traditional radical gastrectomy and lymph node dissection. The study group underwent radical gastrectomy with vagus nerve preservation. The anesthesia method was tracheal intubation anesthesia. Samples were taken from the gastric wall at the branch of blood vessel and between the branches of blood vessel, and HE staining was performed to make tissue sections, and the distribution and number of parietal cells were observed. Each slice counts 5 fields of view, and the number of slices in the same part is averaged. Finally, HSV is combined for comprehensive analysis. Tumor sites included: upper stomach in 6 cases (14.6%), middle stomach in 23 cases (56.1%) and lower stomach in 12 cases (29.3%). Then the pancreatic capsule is cut open, the common hepatic artery is lifted up, the lymph nodes are cleaned by extending the common hepatic artery, and then the vagus nerve is towed behind the cardia to find the celiac branch of the vagus nerve, and the vagus nerve is towed to the right at the same time. The posterior trunk of the vagus nerve is gently towed to the right behind the cardia with a gauze strip, and the celiac branch of the vagus nerve can be sensed by palpation down the posterior trunk, and is freed and towed to the right with a traction wire. Tracing down to find the abdominal branch and the posterior gastric branch, exposing the left gastric artery and its ascending branch, and identifying the relationship between the abdominal branch and the left gastric artery. If they go together, they will be stripped to the root of the left gastric artery. If the two are separated, they will be separated respectively. The distal ligature of the left gastric artery was pulled to the left to clearly reveal several posterior gastric branches from the posterior trunk. The posterior branch and its branches were retained, and connective tissues such as peripheral lymph fat were removed in one piece. The ligature at the distal end of the left gastric artery was pulled to the left, and after the posterior branch and related branches were preserved, the surrounding lymph nodes and connective tissue were cleaned.

2.3 Observation Items

The operation time, blood loss, first exhaust and defecation time of the two groups were observed, and the postoperative complications were recorded in detail.

2.4 Statistical Method

SPSS13.0 statistical software was used for analysis. The measurement data were expressed as mean \pm standard deviation ($\bar{x} \pm s$). Paired t analysis was used for comparison between groups. Group t test was used for comparison within groups. χ^2 test was used for the counting data, $P < 0.05$ was statistically significant.

3. Result

There were significant differences between the two groups in the amount of intraoperative bleeding, operation time, first exhaust time and first non stool time ($P > 0.05$). The difference between the study group in the amount of intraoperative bleeding and the control group was statistically significant ($P < 0.05$), as shown in Table 1.

The main complications in the two groups after operation were eating discomfort, habitual diarrhea, bile reflux, etc. In the study group, eating discomfort occurred in 1 case, habitual diarrhea occurred in 2 cases, and the incidence of complications was 23.35%. The incidence of complications was 28.81%. The difference between the two groups was statistically significant ($P < 0.05$), as shown in Table 2.

Table 1 Comparison of Intraoperative Blood Loss, Operation Time, First Exhaust Time, and First Defecation Time between Two Groups of Patients ($\bar{x} \pm s$)

Group	Number of cases	Intraoperative hemorrhage (mL)	Operation time (h)	First exhaust time (h)	First defecation time (h)
Research group	30	303.41±40.18	4.33±0.71	70.21±5.63	93.81±8.85
Control group	30	302.17±39.96	3.86±0.18	104.18±5.81	125.44±9.12

Table 2 Comparison of Postoperative Complications between the Two Groups (n)

Group	Number of cases	Postprandial discomfort	Cholelithiasis	Diarrhea	Bile reflux	Incidence of complications (%)
Research group	30	1	5	2	4	23.35%
Control group	30	5	6	4	3	28.81%

4. Discussion

Surgery is the preferred method for clinical treatment of gastric cancer. Treatment ranges from simple resection of tumor to resection of primary tumor and affected organs, and gradually develops from radical resection of tumor to improvement of postoperative quality of life of gastric cancer patients [3]. Traditional radical resection of gastric cancer is to remove perigastric lymph nodes and vagus nerve, thus achieving the goal of radical resection. The posterior trunk of vagus nerve gives off the posterior gastric branch and the abdominal branch. The posterior branch of the stomach descends along the small curvature of the stomach and branches to the posterior wall of the stomach. The lower part of gastric body and antrum return in the form of celiac branch. A small number of the posterior ramus of the fundus of the stomach directly rises from the posterior trunk behind the abdominal segment of the esophagus and descends along the posterior esophagus to reach the posterior wall of the fundus of the stomach. Some literatures refer to the fundus branch of the Zemen stomach as “sinful nerve”. If there are more than 2 branches in front of and behind the abdominal segment of esophagus, how should they be named? Are they both called anterior trunk and posterior trunk? Ma lechi et al. made a distinction and divided it into trunk, accessory trunk and superior septal gastric branch. As the main component of autonomic nervous system, vagus nerve is mainly responsible for gastrointestinal tract of human body, which can effectively promote pancreas to secrete pancreatic juice, and can better regulate intestinal peristalsis and prevent abdominal distension [4]. During the operation, the liver can be pulled up to the right with the plate hook, and the stomach can be pulled down to the left. After tightening the small omentum, it is not difficult to identify. It is also possible to find the anterior trunk in front of the esophagus (a cord touched by hand) and then search for the hepatic branch step by step downward. The origin of the hepatic branch can be found within 0.5cm above and below the cardia. There are reports that the incidence rate of postoperative complications of gastric cancer is 30% and the mortality rate is 10%[5]. Therefore, it is completely feasible to preserve the hepatic branch of vagus nerve during radical gastrectomy for gastric cancer.

Anatomical studies show that the hepatic branches participate in the formation of the hepatic plexus after the right row, and descend along the duodenal ligament after branching to the gallbladder and liver. The pyloric branches are distributed in the pyloric sinus, while the branching to the duodenum form nerve bundles between the hepatic proper artery and the common bile duct, under the peritoneum of the hepatoduodenal ligament, and the final branches are distributed in the upper duodenum [6]. However, the removal of vagus nerve in gastric cancer patients will affect the normal physiological function of stomach and intestine and lead to disorder. Meanwhile, the secretion of gastric juice will decrease and the acidity in stomach will decrease, which will directly affect and destroy the barrier function of gastric mucosa [7]. The quality of life and nutritional status are poor, and the incidence of complications is high. The posterior trunk of vagus nerve

descends along the small curvature of the stomach. When the posterior trunk reaches the left gastric artery, it branches off the abdominal branch and then reaches the celiac plexus along the upper surface of the artery. The distance from the pylorus midpoint is 4.6-8.0cm. At the small curvature of the stomach, the anterior branch of the stomach and the posterior branch of the stomach began to be cut off from the gastric body [8]. We believe that the main anterior gastric nerve or the main posterior gastric nerve should be the one with the hair branches distributed in the fundus, body or pylorus. If it is only distributed in the pylorus, it is called anterior branch of pylorus or posterior branch of pylorus. In our observation, there are 2 cases, which are only distributed in pylorus. Although the location where they are emitted is relatively high, they also walk along small curvature of stomach, but they should not be called anterior and posterior nerves of stomach. However, the peripheral lymph nodes are all on the lateral side of the vascular nerve capsule and are arranged in a layered mode, which shows that lymph node dissection and nerve preservation are feasible and will not adversely affect the curative effect of radical surgery.

The results of this study showed that there was no significant difference between the study group and the control group in terms of operation time and intraoperative hemorrhage ($P > 0.05$), but the first time of exhaust and defecation in the study group was significantly earlier than that in the control group, and the incidence of complications in the study group was significantly lower than that in the control group ($P < 0.05$). This shows that the radical gastrectomy with preservation of vagus nerve can give full play to the liver, gallbladder, pancreas and intestinal functions of patients after operation. The left gastric artery is surrounded by connective tissue in the gastric and pancreatic folds, and the lymphatic vessels along the left gastric artery surround the connective tissue. The nerve fibers of the celiac branch are distributed in the connective tissue around the artery. These anatomical bases suggest that lymph node dissection can be completed while preserving vagus nerve and its branches. We believe that the anterior branch of the stomach and the posterior branch of the stomach should be divided into the gastric body branch and the gastric fundus branch. Because these two types of branches are not only distributed in different ranges, but also have different origins, highly selective gastric vagotomy should cut off these two types of branches. Vagus nerve preservation radical gastrectomy for gastric cancer has the advantages of safety, low invasiveness and remarkable radical effect, can stabilize the gastrointestinal microenvironment of patients to the greatest extent, obviously reduce the incidence rate of postoperative complications of patients, and improve the quality of life of patients. The physiological condition of digestive tract is guaranteed to the greatest extent, and the incidence rate of postoperative complications of patients is reduced.

Regardless of the relationship between the anatomical structure of vagus nerve and the left gastric artery, the abdominal branch can be preserved. In the case of compact type, the cardia branch of the left gastric artery can be selected to be preserved together, and the descending branch of the left gastric artery can be severed. Those distributed in the anterior wall of pylorus are called anterior branches of pylorus. The posterior branch of pylorus is distributed in the posterior wall of pylorus [9]. Also called anterior branch of gastric antrum and posterior branch of gastric antrum. We think it is more appropriate to call the anterior branch of pylorus and the posterior branch of pylorus. Because it is not only distributed in the pyloric sinus but also in the entire pyloric region. Reviewing the overseas laparoscopic literature, there are many reports of large-scale laparoscopic highly selective vagotomy cases in different periods in many hospitals, among which there are many prospective randomized studies that confirm that the incidence of postoperative complications is significantly lower than that of open surgery. Therefore, we believe that the indications for this operation should be early gastric cancer or early progressive gastric cancer. However, this operation is difficult and must be performed by experienced doctors. At present, there is no prospective randomized controlled study on the safety and long-term effects of oncology. Therefore, we must strictly grasp the indications and make a good preoperative diagnosis.

5. Conclusion

All the data in this study were obtained during laparoscopic gastric cancer surgery. The lengths

of the left gastric artery, retrovagal trunk, celiac branch and the common trunk of nerve and left gastric artery were actually measured under laparoscope. These data have not been reported in the previous literature. Vagus nerve-sparing radical gastrectomy is a new operation. It preserves the radical nature of the original radical gastrectomy and pays attention to the preservation function, which is of great significance for improving the postoperative quality of life of patients. The advantage of this measurement method is that it can not only ensure complete vagus nerve resection and shorten the operation time, but also avoid the possibility of surgical infection caused by Congo red liquid smearing. Vagus nerve preserving radical gastrectomy for gastric cancer can maintain the microenvironment of gastrointestinal tract in vivo to the greatest extent, reduce the incidence of postoperative complications, improve the quality of life of patients after surgery, and is worthy of clinical promotion.

References

- [1] Liu Chunyang, Hao Yingxue, Yu Peiwu, et al. (2017). The clinical effect of radical resection of gastric cancer with vagus nerve preserved by Leonardo da Vinci robotic surgery system. *Chinese Journal of digestive surgery*, vol. 16, no. 3, pp. 251-256
- [2] Zhang Chi, Hu Xiang. (2019). Clinical anatomy of the posterior trunk of vagus nerve and its branches under laparoscopy. *Chinese Journal of Practical Surgery*, vol. 39, no. 07, pp. 691-693
- [3] Zhang Yanan, Liu Yongning, Zhang Chi, et al. (2016). Laparoscopic pylorus and vagus nerve gastrectomy cooperation. *Chinese and foreign medical*, vol. 35, no. 17, pp. 46-50
- [4] Ma Lechi, Yang Shenglei, Zhu Chunjing. (2015). Discussion on the clinical effect of radical vagotomy in the treatment of gastric cancer. *World latest medical information abstract*, no. 99, pp. 73-74
- [5] Wang Shuchang, Yu site, Xu Jia, et al. (2017). Application of preserved function gastrectomy in early gastric cancer. *Chinese Journal of gastrointestinal surgery*, vol. 20, no. 10, pp. 1141-1144
- [6] Wang Haigang. (2015). Analysis of clinical effect of radical gastrectomy with vagus nerve preservation. *Trace elements and health research*, vol. 32, no. 4, pp. 84-85
- [7] Guo Fei. (2018). The effect of laparoscopic pylorus sparing and vagus nerve gastrectomy on gastric cancer. *Journal of community medicine*, no. 12, pp. 53-54
- [8] Zhang Chi, Liang pin. (2017). Pylorus and vagus preserving gastrectomy for early gastric cancer. *Chinese Journal of medical education*, vol. 40, no. 07, pp. 591-593
- [9] Zhang Yiqun, Zhou pinghong. (2017). Application value of endoscopy in the diagnosis and treatment of complications of gastric cancer surgery. *Chinese Journal of gastrointestinal surgery*, vol. 20, no. 2, pp. 160-165.