

The technique of delta-shaped anastomosis in laparoscopic distal gastrectomy with D2 lymph node dissection for gastric cancer

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ABSTRACT

Background: The study aimed to evaluate the initial outcome of the technique of delta-shaped anastomosis in laparoscopic distal gastrectomy with D2 lymph node dissection for the treatment of gastric cancer. **Materials and Methods:** A prospective descriptive study was done. The study included 35 patients who underwent Delta-shaped anastomosis in laparoscopic distal gastrectomy from December 2022 to August 2023 at Nghe An Friendship General Hospital. **Results:** The mean age was 64.8 ± 11.0 (47 – 93). The location of the lesion was mainly in the antrum of the stomach, accounting for 82.9%. There were 2.9% of cases having incidents during the surgery and 2.9% of cases having complications after the surgery. There were 5.8% cases of technical errors in making a delta-shaped anastomosis during surgery. No anastomotic leakage or death was observed after the surgery. The operation time was 156.8 ± 15.8 (130 - 190) minutes. The mean hospital stay was 6.6 ± 0.5 (6 - 8) days. **Conclusion:** The technique of Delta-shaped anastomosis in laparoscopic distal gastrectomy with D2 lymph node dissection is safe and effective in the treatment of gastric cancer.

Keywords: Gastric cancer, delta-shaped anastomosis, totally laparoscopic distal gastrectomy

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INTRODUCTION

Gastric cancer (GC) is a prevalent cancer in Vietnam and other Asian countries such as Japan, South Korea, and China [1],[2]. Multimodal treatment is required for GC, with radical surgery remaining the primary treatment option [3]. However, the issue of restoring gastrointestinal continuity in a physiological and safe manner after gastrectomy remains a challenge for surgeons. To date, many studies and reports on methods for restoring gastrointestinal continuity after open distal gastrectomy

have been widely accepted and applied in clinical practice.

In 1991, Kitano performed the first laparoscopic distal gastrectomy in the world [3], and in 1994, Kitano also performed the first Billroth I gastroduodenostomy via laparoscopic-assisted surgery [2],[3]. However, Billroth I gastroduodenostomy in laparoscopic distal gastrectomy remains challenging, with only a few techniques such as conventional Billroth I and Orvil being performed through laparoscopic or laparoscopic-assisted suturing, and these

techniques are still under investigation by surgeons.

In 2002, Kanaya first reported the Delta-shaped gastrodudenostomy, introducing a new approach for fully laparoscopic reconstruction after distal gastrectomy [4]. This technique has been widely applied in countries like Japan and South Korea (accounting for more than 80%), as well as China, and many studies have compared the short-term and long-term results of the Delta-shaped anastomosis with other techniques such as conventional Billroth I, Orvil, and Roux-en-Y. These studies have shown that the Delta-shaped technique yields comparable short-term and long-term outcomes after distal gastrectomy and offers several advantages in fully laparoscopic surgery, including better physiology and faster postoperative recovery [2],[3],[5].

In Vietnam, studies on this technique remains scant. Therefore, we conducted this study to evaluate initial surgical outcomes of delta-shaped anastomosis technique in laparoscopic gastrectomy with lymph node dissection for gastric cancer.

PATIENTS AND METHODS

Patients

The study included 35 patients who underwent the Delta-shaped technique for anastomosis of the remaining stomach stump with the duodenal stump using a linear stapler in laparoscopic pylorus-preserving gastrectomy to treat gastric carcinoma in the pyloric region stage T1-T3 or \leq IIB [6],[7] at Nghe An General Friendship Hospital.

Methods

A prospective descriptive study was done. All patients had a gastrodudenostomy

using the Delta-shaped technique with a linear stapler after pylorus-preserving gastrectomy from December 2022 to August 2023.

Research Indicators:

Patient characteristics included age, gender, ASA (American Society of Anesthesiologists) classification, BMI (Body Mass Index), and location of gastric lesions. Surgical outcomes included blood loss during surgery, operation time, intraoperative complications, distance from the lesion to the upper resection margin, and pathological results of the resection margin after surgery. Early results included postoperative complications, time to first flatus, time to nasogastric tube removal, time to start oral intake after surgery, and postoperative hospital stay duration.

Delta-Shaped Anastomosis Technique: The patient was placed in a supine position with legs spread apart. The surgeon stood on the left side and inserted five trocars, then proceeded to dissect the stomach and perform a D2 lymph node dissection. The remaining stomach stump was anastomosed to the duodenal stump in the following steps:

Step 1: Transect the stomach using linear staplers, ensuring adequate safety margin and a tension-free anastomosis, and biopsy the resection margin. Make a small incision approximately 1.5 cm at the greater curvature of the stomach near the resection margin to insert the anastomosis device.

Step 2: Transect the duodenal stump about 1 cm below the pylorus, ensuring the posterior side of the duodenal stump is sufficiently long (≥ 2.5 cm). Make a small incision approximately 1 cm at the inferior border of the duodenal stump near the

resection margin to insert the anastomosis device.

Step 3: Insert the first stapler through the two small incisions in the stomach and duodenum (Figure 1), anastomosing the posterior sides of the stomach stump and duodenal stump (creating a cone-shaped resection margin). Check and control bleeding at the resection margin if necessary.

Step 4: Use the second stapler to close the base of the anastomosis (Figure 2), forming a delta-shaped anastomosis. Simultaneously, insert a gastric tube through the anastomosis to inflate or instill water through the tube to check for patency and seal of the anastomosis (Figures 3 and 4).

The data was analyzed using SPSS 26.0 software.

RESULTS

The mean age was 65 years old (ranged 47-93 years). The BMI ranged from 18.6 kg/m² to 23.3 kg/m². The male/female ratio was 3.3/1. Preoperative health status showed that 85.7% were ASA1 and ASA2. The primary lesion location was in the gastric antrum, accounting for 82.9%. The main stages of the disease were stages I and II, accounting for 90.5%. There were 3 patients in stage IIIA and 1 patient in stage IIIB postoperatively. These patients had tumors ≤ T3 preoperatively, stages IIA and IIB, but the number of metastatic lymph nodes postoperatively reached N2 and N3a levels. (Table 1)

Table 1. Patients' characteristics (n = 35)

Characteristics		Mean ± SD or frequency (percentage)
Age (year)		64.8 ± 11.0 (47 – 93)
BMI (kg/m ²)		20.1 ± 1.2 (18.6 – 23.35)
Gender	Man	27 (77.1%)
	Women	8 (22.9%)
ASA	ASA1	18 (51.4%)
	ASA2	12 (34.3%)
	ASA3	5 (14.3%)
Lesion location	Antrum	29 (82.9%)
	Pyloric canal	6 (17.1%)
Postoperative staging	IA	4 (11.4%)
	IB	18 (51.4%)
	IIA	4 (14.1%)
	IIB	5 (14.3%)
	IIIA	3 (8.6%)
	IIIB	1 (2.9%)

All patients underwent laparoscopic surgery with a Delta-shaped technique for gastroduodenal anastomosis using linear staplers. Intraoperative complications occurred in 2.9% of cases, with

one case of vascular injury to the branch on the superior edge of the duodenum (duodenal arteries 1, 2) causing bleeding (about 150ml) during anastomosis. Technical errors occurred in 5.8% of cases where the second stapler did not close the anastomosis properly, requiring reinforcement with an X-shaped stitch using 3.0 vicryl sutures. One case required conversion to Billroth II anastomosis due to perforation of the superior edge of the duodenum by the first stapler, and this case was excluded from the report. The mean operation time was 156.8 ± 15.8 minutes, with the shortest being 130 minutes and the longest being 190 minutes. The shortest distance from the superior edge of the lesion to the resection margin was 3cm, and the longest was 7cm, with 100% of resection margins being free of cancer cells. (Table 2)

Table 2. Surgical outcomes (n = 35)

Outcomes	Mean \pm SD or frequency (percentage)
Intraoperative complications	1 (2.9%)
Technical error while making anastomosis	2 (5.8%)
Operation time (min)	156.8 ± 15.8 (130–190)
Blood loss (mL)	27.4 ± 22.9 (15 – 150)
Distance from lesion to upper margin (cm)	4.57 ± 1.17 (3 – 7)
Negative margin	35 (100%)

Postoperative complications occurred in 2.9% of cases with acute pancreatitis, all of which were treated conservatively and discharged in stable condition. Anastomotic leakage, other complications, or postoperative mortality were not seen. The mean hospital stay was 6.6 days. The indwelling nasogastric tube time was 1.4 days (67.5% retained for 1 day, 28.6% for 2 days, and 5.7% for 3 days). (Table 3)

Table 3. Postoperative results (n = 35)

Postoperative results	Mean \pm SD or frequency (percentage)	
Postoperative complication	Pancreatitis	1 (2.9%)
	No complication	34 (97.1%)
Indwelling nasogastric tube time (day)	1.4 ± 0.6 (1 – 3)	
Indwelling abdominal drainage (day)	2.06 ± 0.59 (1 – 4)	
Time to pass gas (day)	50.3 ± 6.9 (48 – 72)	
Time to oral feeding (day)	2.1 ± 0.47 (1 – 4)	
Hospital stays (day)	6.6 ± 0.5 (6 – 8)	

DISCUSSIONS

The mean age of patients was 64.8 ± 11.0 years, with the youngest being 47 years old and the oldest being 93 years old. The majority of patients were men (77%). According to studies by authors on GC in countries such as Japan, South Korea, China, and Vietnam, the mean age of onset was 62.7 - 64.8 years [2],[3],[5]. The mean BMI was 20.1 ± 1.2 kg/m², with the lowest being 18.6 kg/m² and the highest being 23.3 kg/m². Most of the patients had good preoperative health status with 8% of ASA1 and ASA2. We indicated distal gastrectomy with Delta-shaped anastomosis for GC cases in the antrum and pyloric canal at stages T1-T3 and \leq IIB, but postoperatively, in our study, there were 3 (8.6%) patients at stage IIIA and 1 (2.9%) at stage IIIB due to postoperative lymph node metastasis levels at N2 and N3a, which increased the postoperative stage.

In our study, 82.9% of lesions at T1-T3 were in the antrum, and 17.1% were in the pyloric canal, which aligned with the indications for distal gastrectomy with Delta-shaped anastomosis used by authors domestically and internationally [6],[7],[8],[9]. One concern was whether the distance from the lesion margin to the upper resection margin was cytologically safe in cancer cases. Recent studies indicated this distance can be 2 cm or more for ulcerated GC, provided the resection margin biopsy is cancer-free, particularly in the early stages. In this study, the distance from the upper lesion margin to the upper resection margin ranged from 3 cm to 7 cm, with an average of 4.57 cm. All resection margins were cancer-free. For lesions extending to the vertical portion of the lesser curvature, we used the Billroth II method. According to Japanese authors, the minimum distance from the lesion margin to

the upper resection margin should be at least 5 cm [8],[9],[10].

We performed the Delta-shaped anastomosis in laparoscopic distal gastrectomy, connecting the remaining stomach to the duodenal stump using linear staplers. We found that laparoscopic anastomosis had several advantages over laparoscopic-assisted or open surgery, such as a wider surgical field, easier manipulation for the surgeon, fewer anastomoses (only one), reduced risk of anastomotic complications, easier surgical maneuvers, shorter operation times, smaller incisions, and faster postoperative recovery.

The mean blood loss was 27.4 ± 22.9 (15 - 150) ml. The mean operation time was 156.8 ± 15.8 (130 - 190) minutes. The mean postoperative hospital stay was 6.6 ± 0.5 (6 - 8) days. Han Hong Lee et al.'s study on 138 patients with Delta-shaped anastomosis after distal gastrectomy reported an average surgery time of 220.4 minutes, average intraoperative blood loss of 99.8 ml, average time to start oral intake of 4.6 days, and average postoperative hospital stay of 8.5 days [5]. Kigatami et al.'s study on 68 patients with Delta-shaped anastomosis reported an average surgery time of 230 minutes and average intraoperative blood loss of 21.5 ml [3].

Regarding complications, there was 1 case (2.9%) of intraoperative complications due to damage to the branch of the superior duodenal artery (2nd part) during anastomosis, causing about 150 ml of blood loss. The cause was maneuvering the upper border of the duodenal stump into the second stapler before stapling. We controlled the bleeding using laparoscopic vascular clips. The patient had a stable postoperative course and was discharged on the 7th day. There

were 2 technical errors during anastomosis due to incomplete control of the resection margin, leading to a non-sealed anastomosis. We sutured the anastomosis with an X-stitch using 3.0 Vicryl. Both patients had a stable postoperative course and were discharged on the 7th day. One case required conversion to Billroth II due to perforation of the upper border of the duodenal stump when inserting the first stapler, resulting in insufficient stump length for Delta-shaped anastomosis. This case was included for discussion only because this study focused on Delta-shaped anastomosis. Our initial results suggested that Delta-shaped anastomosis was feasible, and not challenging to perform. This significantly reduced operation time and had acceptable rates of intraoperative complications and technical errors compared to studies from countries with the highest GC rates and surgical expertise, such as Japan, South Korea, and China [10],[11].

The postoperative complication rate was low with only 1 case (2.9%) of acute pancreatitis, likely due to microtrauma to the pancreatic parenchyma during lymph node dissection. Postoperative blood amylase levels increased (1150 UI), so we administered pancreatic secretion inhibitors (octreotide) and monitored pancreatic enzymes. The patient gradually stabilized from the 3rd to the 5th postoperative day and was discharged on the 8th day. There were no cases of anastomotic leakage or other complications, nor any postoperative mortality. Kigatami et al.'s study on 68 patients with Delta-shaped anastomosis reported a 2.94% complication rate (1 case of early bowel obstruction and 1 case of acute pancreatitis) [3]. Han Hong Lee et al.'s study on 138 patients with Delta-shaped anastomosis after distal gastrectomy reported an 8% complication rate, including

pneumonia (0.7%), acute pancreatitis (1.4%), anastomotic leakage (1.4%), anastomotic stenosis (1.4%), postoperative bleeding (0.7%), early bowel obstruction (1.4%), and wound infection (0.7%) [5].

CONCLUSIONS

The technique of delta-shaped anastomosis in laparoscopic distal gastrectomy with D2 lymph node dissection for gastric cancer is safe and effective. Further randomized-controlled trials should be done to confirm the advantages of this technique compared to others.

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