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Original Research Article

Totally laparoscopic total gastrectomy with technique of functional end-to-end esophagojejunostomy by linear stapler without previous resection of the esophagus and jejunum

Dinh Van Chien[1]*, Nguyen Van Huong[1], Dang Dinh Khoa[1], Nguyen Van Thuy[1], Ha Van Quyet[2], Pham Van Duyet[2], Pham Van Thuong[2], Dang Quoc Ai[3]

[1]Nghean Friendship General Hospital, Vietnam
[2]Haiphong University of Medicine and Pharmacy, Vietnam
[3]Hanoi Medical University Hospital, Vietnam

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***Correspondence:**
Dr. Dinh Van Chien,
E-mail: chienbvna@gmail.com

ABSTRACT

Background: The technique of esophagojejunostomy in totally laparoscopic total gastrectomy is difficult and had a high frequency of incidents during surgery and anastomotic leakage. We aimed to evaluate the outcomes of the technique of functional end-to-end esophagojejunostomy by linear stapler without previous resection of the esophagus and jejunum in the totally laparoscopic total gastrectomy with D2 lymph node dissection in the treatment of gastric cancer.
Methods: A prospective observational study on patients received technique of functional end-to-end esophagojejunostomy by linear stapler without previous resection of esophagus and jejunum between July 2017 to July 2020.
Results: We included 70 patients with a mean age of 62.5. There were 80% of patients having tubular adenocarcinoma and papillary adenocarcinoma, 11.4% of patients having tumors in the upper third of the stomach, and 81.4% of patients having tumors in the middle of the stomach. There were 4.2% of cases having incidents during the surgery and 2.8% of cases having complications after the surgery. No anastomotic leakage or death was observed after the surgery. The mean lymph node was 23, and the mean metastatic lymph node was 2.7. The operation time was 203.8 minutes. The mean hospital stay was 8.0 days. The one year survival after the surgery was 97.9%, and two year survival was 93.1%. The mean survival was 35.3 months.
Conclusions: TLTG with D2 lymph node dissection using functional end-to-end esophagojejunostomy by linear stapler without previous resection of esophagus and jejunum was safe and effective in gastric cancer treatment.

Keywords: Functional end-to-end esophagojejunostomy, Laparoscopy, Gastric cancer

INTRODUCTION

Gastric cancer is popular in the world including Vietnam.[1] Despite there is a variety of treatments for gastric cancer, surgery is the most effective approach. Azagra is the first one who conducted the laparoscopic total gastrectomy in 1993.[2] Until now, this approach was widely applied and benefited patients. Its advantages include the small scar, mild pain after surgery, little blood loss, a fast time for recovery, low frequency of incidents and complications after surgery, good quality of life and

longer survival for the patients and expanding the survival in patients.[3-5]

The technique of esophagojejunostomy in totally laparoscopic total gastrectomy (TLTG) is difficult and had a high frequency of incidents during surgery and anastomotic leakage. There are various pieces of the technique of esophagojejunostomy in TLTG, for example, overall, overlap, functional, etc. using ciculars or linear staplers. They bring many benefits for patients. However, the difficult procedures, therefore, we conducted this study to evaluate the efficacy of the technique functional end-to-end esophagojejunostomy by linear stapler without previous resection of esophagus and jejunum in gastric cancer treatment.

METHODS

Study participants and design

We included 70 patients who were prescribed TLTG for cancer treatment with technique of functional end to end esophagojejuostomy by linear stapler without previous resection of the esophagus and jejunum in Nghe An friendship general hospital from July 2017 to July 2020. Current study is a prospective observational study, TLTG with technique of functional end to end esophagojejuostomy by linear stapler without previous resection of the esophagus and jejunum. All patients who underwent TLTG with the technique as indicated above and satisfied the inclusion criteria were included in the analysis. The study was approved by the ethics committee of Nghe An friendship general hospital. All participants agreed to engage the study. The study was conducted complying with the declaration of Helsinki.

Inclusion and eclusion criteria

Patients who had tumors in the upper part of the stomach, non-invasive esophagus, or the distance from tumor margin to cardia <6 cm, depth of invasion from T1a to T4A, and TNM stage ≤IIIC. The inclusion criteria were patients who had ASA (American society of anaesthesiologists) classification I, II, or III; agreed to take part in the study, and agreed with the prescribed surgery. Patients were excluded if they had the invasion level of T4b and invaded esophagus; tumor level at stage IV; the distance between the tumor margin and cardia >6 cm; ASA classification ≥IV; were contraindicated with the laparoscopy; did not agree to engage in the study or did not agree to undergo a surgery.

Study outcomes

Patients' characteristics; age, gender, ASA, the location and size of tumors, anatomic pathology, tumor stage, method of gastrectomy, and method of the anastomosis.
Surgical outcomes: The rate of open gastrectomy conversion, the operation time, level of lymph nodes dissection, the level of lymph nodes migration, incidents during the surgery. Primary outcomes; time to first flatus, time to drain removal, time to diet, complications after the surgery, level of postoperative pain, hospital stay. Secondary outcomes; the survival followed by the Nghe An friendship general hospital.

Surgical procedure

The surgical procedure was conducted following the steps mentioned below. The patient was placed in the supine split-leg position, the surgeon stood at the left side. Trocar placement; a 10 mm trocar was placed below the navel, a 12 mm trocar was placed under the left rib, two 5 mm trocars under right rib. Step 1; evaluating the tumor and the possibility of gastrectomy, step 2; cutting greater omentum, thoroughly cutting the gastrosplenic omentum, dissecting lymph-nodes of stations 4d, 4sb, 4sa, 11d, 10, and 2, then exposing the left side of the cardia, step 3; dissecting lymph-nodes of stations 6, 14v, conducting the dissection of the right gastroepiploic vessels at their origin, step 4; dissecting lymph-nodes of stations 3, 5, 8a, 12a; then narrowing the right gastroepiploic artery which is close to the hepatic artery, step 5; dissecting lymph-nodes of stations 7, 9, 11p, narrowing left gastric vein which is close to the root of the artery via clips, and narrow the origin of the artery which is close to the celiac trunk via 2 hemolocks, step 6: cutting the rest of omentums, dissecting lymph-nodes of station 1, exposing the mobilizing the cardia, step 7; Conducting functional end to end esophagojejunostomy by linear staplers without previous resection of esophagus and jejunum (Figure 1), performing end-to-side jejunojejunostomy anastomosis by linear staplers, step 8; cutting, closing the duodenal bulb using linear stapler 1-1.5 cm from the pylorus, step 9; flushing and rinsing the abdomen, inserting a drain tube under the liver and spleen, step 10; collecting specimens via trocar 12 and closing the skin of trocar wounds. Esophagus and jejunum resection, esophagojejunostomy, cutting esophageal jejunum and tightly close the anastomosis, anastomosis, examining the anastromosis via laparoscopy and X-ray. The experimental data was statistically analysed using SPSS 22.0.

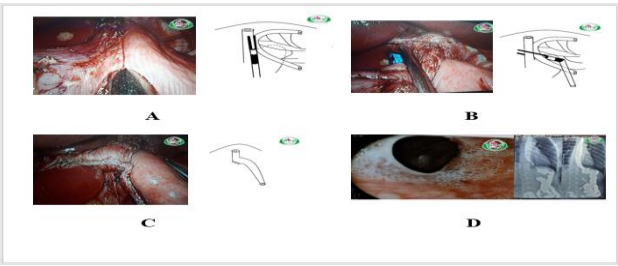

Figure 1: End-to-end esophagojejunostomy anastomosis via linear staplers without before esophagus and jejunum resection. A) esophagojejunostomy, B) cutting esophageal jejunum and tightly close the anastomosis, C) anastomosis, D) examining the anastromosis via laparoscopy and X-ray.

RESULTS

Seventy patients received the technique of functional end-to-end esophagojejunostomy without previous resection of the esophagus and jejunum in the TLTG with D2 lymph node dissection. The results were obtained asmentioned in (Table 1).

Table 1: The study's outcomes.

Parameters	Results	
Age (years)	62.5±10.8 (29-88)*	
Male/female ratio	4.4/1	
Tumor size (cm)	4.1±1.6 (1-9)*	
ASA, N (%)	I	23 (32.9)
	II	43 (61.4)
	III	4 (5.7)
Tumor locations, N (%)	One-third upper	8 (11.4)
	Middle	57 (81.4)
	With ulceration	5 (7.1)
Type of gastric cancer, N (%)	Adenocarcinoma	56 (80.0)
	Mucous carcinoma	2 (2.9)
	Ring cell carcinoma	12 (17.1)
Differentiation, N (%)	High	4 (5.7)
	Moderate	26 (37.1)
	Low or none	40 (57.1)
Incidents during the surgery, N (%)	Splenic injury	1 (1.4)
	Hepatic injury	1 (1.4)
	Serosal laceration of small intestine	1 (1.4)
	Other	0 (0)
Complications after the surgery, N (%)	Pneumonia	1 (1.4)
	Residual abscess	1 (1.4)
	Digestive leakage	0 (0)
	Others	0 (0)
TNM stage, N (%) (JGCA 2011)	IA	3 (4.3)
	IB	11 (15.7)
	IIA	22 (31.4)
	IIB	15 (21.4)
	IIIA	6 (8.6)
	IIIB	10 (14.3)
	IIIC	3 (4.3)
	IV	0 (0.0)
The number of harvested lymph nodes	23.0±8.2 (12-45)*	
The number of migrated lymph nodes	2.7±3.8 (0-13)*	
Operation time (minutes)	203.8±27.4 (160-300)*	
Time of gastric tube removal (hours)	32.6±30.6 (0-148)*	
Time to first flatus (hours)	49.0±14.9 (24-96)*	
Time to drain removal (hours)	3.5±1.3 (2-7)*	
Time to diet (days)	4.4±1.5 (2-6)*	
Pain level (VAS), N (%)	Mild	48 (68.6)
	Moderate	21 (30.0)
	Severe	1 (1.4)
	Extreme severe	0 (0.0)
Hospital stay (days)	8.0±2.2 (6-15)*	
Survival after the surgery (months)	35.3±0.9 (33.5-37.2)*	

*Data is shown as mean ±SD (range), ASA; American society of anesthesiologists, JGCA; Japanese gastric cancer association, VAS; visual analogue scale.

All patients undergoing the technique of functional end-to-end esophagojejunostomy were without previous resection of esophagus and jejunum via linear staplers in the TLTG with D2 lymph node dissection. There were 4.2% of patients having mild incidents during the surgery and being treated during laparoscopic surgery. Among all patients, 2.8% had complications after the surgery and were well internally treated. No death was observed during and after the surgery. All cases had no tumor cells at the proximal and distal resection lines, the distance from the upper injury to the proximal resection line was 5.2±0.9 (2.5-7) cm. The one year survival after the surgery using the Kaplan-Meier method was 97.9%, the two year survival was 93.1%. The survival of patients is presented in (Figure 2).

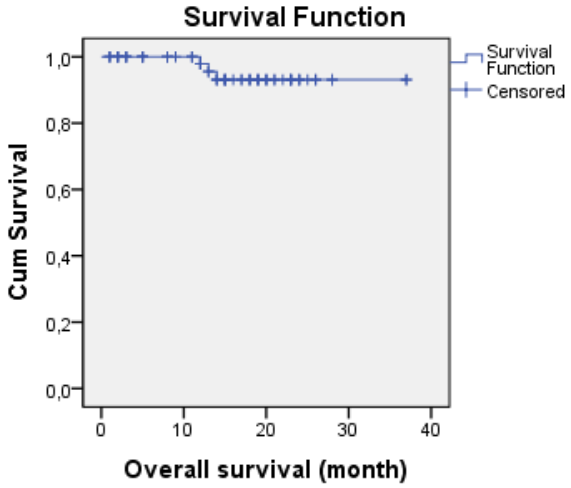

Figure 2: Full length survival of patients.

DISCUSSION

The mean age in the study was 62.5±10.8 in which the youngest was 29 and the oldest was 88. The majority of patients had the age of 50-70 years which accounted for 72.9%. The male/female ratio was 4.4/1. In the previous reports, gastric cancer occurs mainly in patients of 62.7-64.8 years old in Japan, 63.6-73 years old in Europe and USA, and 54.6–57.6 years old in Korea and China.[6-8] We ordered the total gastrectomy for patients having tumors in the cardia, in the corpus, or having gastric cancer with ulceration. Other cases were patients who had the distance from the tumor margin to the cardia <6 cm. This aimed to ensure to remove the tumor cells. This distance in the report of Cristiano was 6.9± 0.8 (6-8 cm).[7]

The distance from the upper injury margin to the proximal resection line plays an important role in TLTG. To prevent the recurrence at the anastomosis, the updated guideline of the Japanese gastric cancer association (JGCA) and the American cancer society suggested that this kind of distance should be at least 5 cm. We conducted the incision 2 cm above the cardia, cut the duodenum at the location 1.5 cm under the pylorus. The results showed that 11.4% of patients having the tumor located at the one-third upper of the stomach, 81.4% of patients having the tumor located in the middle of the stomach, and 7.1% of patients having tumors with ulceration. The mean distance from the upper injury margin to the proximal resection line was 5.2 ± 0.9 (2.5-7) cm. All cases showed no tumor cells residual at the proximal and distal resection lines. All cases had successful TLTG intervention. No case must have the open gastrectomy conversion due to the incidents.

For the technique of recovery of digestive tract circulation, we performed the esophagojejunostomy anastomosis using the technique functional end-to-end with linear staplers (2-3 echelon staplers 60B) without previous resection of esophagus and jejunum.[9-12] We realized that the suture in the TLTG was more beneficial than the suture in the assisted-laparoscopic total gastrectomy or open surgery. These advantages included wide surgical area, easy manipulations, small scar, patients suffering less pain, nice appearance. Especially, there was no death or cases with digestive leakage or narrow anastomosis after the surgery. On the other hand, we did not conduct the resection of the esophagus and jejunum before the anastomosis but did them during closing the anastomosis. This helped to reduce the number of manipulations, ease the procedure, reduce the operation time, and the number of staplers leading to the reductions of operation cost. All cases were cut and close the duodenal bulb using linear staplers.

We used the procedure of D2 lymph node dissection in the total gastrectomy and the tumor stage according to the third conference in 2011 of the JGCA.[13-15] Total harvested lymph nodes were 1611 with a mean of 23.0±8.2 (12-45). Total migrated lymph nodes were 190 with a mean of 2.7±3.8 (0-13). These numbers reported in studies of Western, ranged from 18 to 30.3.[7,16] Our results showed the prevalence of cancer in stages IA, IB, IIA, IIB, IIIA, IIIB, and IIIC was 4.3%, 15.7%, 31.4%, 21.4%, 8.6%, 14.3%, and 4.3%. It was observed that the majority of cancer cases in Vietnam were at stages II and III.

For the incidents during the surgery, our results showed 01 (1.4%) of cases having hepatic injury during the mobilization of the liver leading to the left hepatic hemorrhage, 01 (1.4%) of cases having the bleeding spleen during the mobilization of the reticulum. Another case (1.1%) had the serosal laceration of the small intestine when suturing the digestive tract. The prevalences of incidents during the surgery in other reports were 0.9-7.4%.[3,4,17,18]

For the complications, there was one case (1.4%) having a residual abscess in the left liver. Five days after the surgery, the patient was fever. The result from the abdominal ultrasound showed that there was a buildup of fluid with a size of 3x4.2 cm under the left liver. Using the guided laproscopic drainage obtained 100 ml of fluid. After the internal treatment, the patient was recovered and left the hospital on day 13 after the surgery. There was

also 01 (1.4%) of cases having pneumonia on day 4 after the surgery, then was internal treated and recovered, left the hospital on day 15. No death case after the surgery. The rate of complications in reports in Western ranged from 21 to 26%.[7,16]

For the pain level after the surgery, there were 68.6% of patients having mild pain, 30.0% of patients having moderate pain. No extreme severe pain was observed among patients. After the surgery, patients were treated with conventional pain relief regimen (paracetamol 1 gram) twice a day. We observed that most patients having mild and moderate pain level. One patient had severe pain and was treated with morphine 10 mg twice on the first postoperative day. On the other hand, we recorded that most patients receiving the laparoscopic surgery felt comfortable and did not order the pain relief. The recovery of locomotor was also faster amongst those patients.

The operation time was 203.8±27.4 minutes. The first cases experienced a longer duration of 300 minutes. However, the following cases were finished in a shorter period of time. These results were in line with other reports.[17,19] Time to first flatus was 49.0±14.9 hours which shorter than the report of Noshiro (67.2 hours).[20] The hospital stay was 8.0±2.2 days (6-15 days) which was concordant to other reports.[21,22] Time to drain removal was 32.6±30.6 hours (0-148 hours). The nasogastric tube insertion often made patients uncomfortable and reduced their quality of life. In our study, there were 70 patients did not anastomotic leakage or digestive leakage after the digestive tract circulation using linear staplers. Thus, the nasogastric tube insertion would not essential after the surgery. The results revealed that there were 21 patients (30.0%) not receiving the nasogastric tube insertion and 22 patients (31.4%) receiving nasogastric tube insertion within the first operative day. All cases had no complications relating to the anastomosis. The time to drain removal was 3.5±1.3 days. The one year survival after the surgery was 97.9%, and two year survival after the surgery was 93.1%. The survival at the end of this report was 35.3±0.9 months. In the meanwhile, the one-year survival reported by Chen et al was 91.5%.[21] Other reports in Vietnam revealed that survival ranged from 40.2 to 43.8 months.

CONCLUSION

In conclusion, TLTG with D2 lymph node dissection using the technique functional end-to-end esophagojejunostomy by linear stapler without previous resection of esophagus and jejunum was safe and effective in gastric cancer treatment. Our limitation was the small sample size which led to the difficulty in the comprehensively confirmation of the advantages of the technique. Further studies should be conducted with a larger sample size, in multicenter, and follow patients in a longer period of time to deeper understand the benefits and drawbacks of the technique.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: Globocan estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2018;68:394-424.
2. Azagra JS, Groergen M, Gilbart E, Alonso J, Centerik M. Laparoscopy assisted total gastrectomy with extended D2 lymphadenectomy for cancer: Technical aspect. Le Jour Coelio Chir. 2001;40:79-83.
3. Ye LY, Liu DR, Li C, Li XW, Huang LN, Ye S, et al. Systematic review of laparoscopy assisted versus open gastrectomy for advanced gastric cancer. J Zhejiang Univ Sci B. 2013;14(6):468-78.
4. Chen K, Xu XW, Zhang RC, Pan Y, Wu D, Mou YP. Systematic review and meta analysis of laparoscopy assisted and open total gastrectomy for gastric cancer. World J Gastroenterol. 2013; 19(32):5365-76.
5. Chen K, Pan Y, Cai JQ, Xu XW, Wu D, Mou YP. Totally laparoscopic gastrectomy for gastric cancer: A systematic review and meta-analysis of outcomes compared with open surgery. World J Gastroenterol. 2014;20(42):15867-78.
6. Matsuhashi N, Osada S, Yamaguchi K, Saito S, Okumura N, Tanaka Y, et al. Oncologic outcomes of laparoscopic gastrectomy: a single-center safety and feasibility study. Surg Endosc. 2013;27:1973-9.
7. Huscher CG, Mingoli A, Sgarzini G, Sansonetti A, Di Paola M, Recher A, et al. Laparoscopic versus open subtotal gastrectomy for distal gastric cancer: five-year results of a randomized prospective trial. Ann Surg. 2005;241(2):232-7.
8. Kim HH, Han SU, Kim MC, Hyung WJ, Kim W, Lee HJ, et al. Long-term results of laparoscopic gastrectomy for gastric cancer: a large-scale case-control and case-matched Korean multicenter study. J Clin Oncol. 2014;32(7):627-33.
9. Ebihara Y, Okushiba S, Kawarada Y, Kitashiro S, Katoh H. Outcome of functional end-to-end esophagojejunostomy in totally laparoscopic total gastrectomy. Langenbecks Arch Surg. 2013;398: 475-9.
10. Katai H. Function-preserving surgery for gastric cancer. Int J Clin Oncol. 2006;11:357-66.
11. Lee HH, Song KY, Lee JS, Park SM, Kim JJ. Delta-shaped anastomosis, a good substitute for conventional Billroth I technique with comparable long-term functional outcome in totally laparoscopic distal gastrectomy. Surg Endosc. 2014;29(9):2545-52.
12. Kang SH, Cho YS, Min SH, Park YS, Ahn SH, Park DJ, Kim HH. Intracorporeal esophagojejunostomy

uing a circular or a linear stapler in totally laparoscopic total gastrectomy, a propensity-matched analysis. J Gastric Cancer. 2019;19(2):193-201.
13. Japanese gastric cancer association. Japanese classification of gastric carcinoma. Gastric Cancer. 2011;14:101-12.
14. Japanese gastric cancer association. Japanese gastric cancer treatment guidelines 2014 (ver. 4). Gastric Cancer. 2016;14:1-19.
15. Japanese gastric cancer association. Japanese gastric cancer treatment guidelines 2018 (5th edition). Gastric Cancer. Available at: https://link.springer.com/article/10.1007/s10120-020-01042-y. Accessed on 20 June 2020.
16. Strong VE, Devaud N, Allen PJ, Gonen M, Brennan MF, Coit D. Laparoscopic versus open subtotal gastrectomy for adenocarcinoma: a case–control study. Ann Surg Oncol. 2009;16:1507-13.
17. Kitano S, Shiraishi N, Uyama I, Sugihara K, Tanigawa N. A multicenter study on oncologic outcome of laparoscopic gastrectomy for early cancer in japan. Ann Surg. 2007;245(1):68-72.
18. Han G, Park JY, Kim YJ. Comparison of short-term postoperative outcomes in totally laparoscopic distal gastrectomy versus laparoscopy-assisted distal gastrectomy. J Gastric Cancer. 2014;14(2):105-10.
19. Chen QY, Huang CM, Lin JX, Zheng CH, Li P, Xie JW, et al. Laparoscopy-assisted versus open D2 radical gastrectomy for advanced gastric cancer without serosal invasion: a case control study. World J Surg Oncol. 2012;10:248-57.
20. Noshiro H, Nagai E, Shimizu S, Uchiyama A, Tanaka M.Laproscopicallly assisted distal gastrectomy whith standard radical lymph node dissection for gastric cancer. Surg Endosc. 2015;19: 1992-6.
21. Chen K, Mou YP, Xu XW, Cai JQ, Wu D, Pan Y. Short-term surgical and long-term survival outcomes after laparoscopic distal gastrectomy with D2 lymphadenectomy for gastric cancer. BMC Gastroenterol. 2014;14:41-8.
22. Lee SE, Kim YW, Lee JH, Ryu KW, Cho SJ, Lee JY, et al. Developing an institutional protocol guideline for laparoscopy-assisted distal gastrectomy. Ann Surg Oncol. 2009;16:2231-6.

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