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RESEARCH ON THE APPLICATION OF LAPAROSCOPIC TOTAL GASTRECTOMY WITH D2 LYMPHADENECTOMY IN THE TREATMENT FOR GASTRIC ADENOCARCINOMA

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PUBLICATIONS

1. Dinh Van Chien, Nguyen Van Huong, Pham Van Anh (2019), "Outcomes of laparoscopic gastrectomy in Nghe An Friendship General Hospital*". The first congress upper gastro - intestinal society of ASEAN 2019*, Abstract report, PP:53.
2. Dinh Van Chien et al (2020), "Totally laparoscopic total gastrectomy with technique of functional end-to-end esophagojejunostomy by linear stapler without previous resection of the esophagus and jejunum". *International Surgery Journal* | November 2020 | Vol 7 | Issue 11. PP: 3614-3619.
3. Dinh Van Chien et al (2019), "Initial results of laparoscopic complete resection of D2 lymph node dissection in the treatment of gastric carcinoma". Vietnam Journal of Laparoscopic and Endoscopic Surgery. Number 1 – Vol 9/2019. PP: 44-49.
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INTRODUCTION

1. Rationale of the study

Gastric cancer is a common malignant disease. This is the third-leading cause of cancer deaths in the world, following lung cancer and rectal cancer. The major of gastric cancer is gastric adenocarcinoma which accounts for 95% of cases. Annually, over one million new cases of gastric cancer are reported over the world.

The highest prevalence of gastric cancer is found in East Asia, Central Asia, and Latin America. Korea is the country that has the highest rate of gastric cancer by about 60 of 100000 cases in males and 25 of 100000 cases in females. The prevalence of new cases in Vietnam is 23.3 of 100000 cases in males and 10.2 of 100000 cases in females. Annually, about 738000 cancer deaths because of gastric cancer occur which accounted for 8.3% of cancer deaths. The mortality caused by gastric cancer in Vietnam is 19.7 of 100000 cases in males and 8.7 of 100000 cases in females. The common age of gastric cancer is 62.7 – 64.8 and 63.6 – 72 years reported by Japanese authors and European and American, respectively.

Laparoscopic total gastrectomy (LTG) with lymphadenectomy is the most popular and critical method in the cure of gastric carcinoma. The choice of surgical method and the intensity of lymphadenectomy depend on the location, size, and level of invasion of tumors.

LTG is commonly applied in tumors occurring at one-third upper and middle of the stomach. Carl B. Schlatter is the first surgeon who successfully performed a total gastrectomy in the treatment of gastric cancer in 1897. In total gastrectomy in the treatment of gastric cancer, lymphadenectomy plays a critical role that contributes to the cancer cure and is also a standard strategy being widely applied in the world.

In 1999, Umaya et al. are the first people who reported a case of LTG with splenectomy and distal pancreatectomy, D2 lymphadenectomy. In the same year, Azagra et al. also reported 12 cases of total gastrectomy. Shinorhara (2009) reported LTG with D2 lymphadenectomy and with functional esophagojejunostomy in 55 gastric cancer patients having tumors at T2-T4. The outcomes indicated 13% of the pancreatic leak, 5% of residual abscess, 5% of bowel obstruction due to herniation, and no case of an anastomotic leak or open surgery transfer. Ebihara Y. reported 65 patients undergoing totally LTG with lymphadenectomy with the technique of functional end-to-end esophagojejunostomy. The results showed that there were 15% complications among cases in general in which 1.5% had a leak of the duodenal cap, 1.5% had a jejunojejunal anastomotic leak, 4.6% had narrowing of anastomosis, and 3.1% had infectious incision.

Currently, according to the recommendation of the Japanese Gastric Cancer Association (2014), the standard procedure D2 lymphadenectomy is applied in tumors at stages of T2 – T4 as well as cT1N+.

The advantages of totally LTG with D2 lymphadenectomy in the treatment of gastric cancer reported in many studies in Vietnam and around the world include less pain after surgery, short time of recovery, low risk of infectious incision, acceptable aesthetic, and complying rules of cancer cure as well as recovery of gastrointestinal circulation after the surgery. To apply the totally LTG with D2 lymphadenectomy and improve the quality of treatment in gastric carcinoma patients, we conducted the study "Research on the application of LTG with D2 lymphadenectomy for gastric carcinoma" with two aims:

1. Study on clinical and paraclinical characteristics and lesions of gastric cancer of patients applying the technique of laparoscopic total gastrectomy with D2 lymph node dissection.

2. Evaluate surgical outcomes of laparoscopic total gastrectomy with D2 lymphadenectomy at Nghe An Friendship General Hospital, Vietnam.

1. Scientific contribution and practical aspects of this dissertation

Total gastrectomy with D2 lymphadenectomy in the treatment of gastric adenocarcinoma is major surgery and is difficult to conduct, thus, there is a need for profound study of this topic with the aim of improving and applying advanced techniques in total gastrectomy and improve the treatment outcomes as well as the quality of life of gastric patients who require total gastrectomy.

Reports of LTG with D2 lymphadenectomy in the treatment of gastric adenocarcinoma are mainly in developed countries in the world.

Therefore, we conducted this study aiming to apply the LTG with D2 lymphadenectomy in the treatment of gastric adenocarcinoma at Nghe An Friendship General Hospital. This is expected to enhance the quality of treatment in patients, harmonize the surgical technique of the hospital with characteristics of gastric adenocarcinoma requiring total gastrectomy, hospital infrastructure, as well as reduce operative time, time of recovery postoperatively, and treatment cost. The cost relates to the additional surgeons standing on the left, liver hanging step in the abdomen for a larger surgical space, creation of end-to-end esophagojejunal anastomosis using a linear stapler without previous resection of esophagus and jejunum, cutting and closing the duodenal cap after lymphadenectomy, and making anastomosis, etc.

The findings in this dissertation confirmed that LTG with D2 lymphadenectomy is safe and effective in the treatment of gastric adenocarcinoma, and is possible to conduct at health centers having laparoscopy surgery instruments as well as trained practitioners.

DISSERTATION LAYOUT

The dissertation is presented in 151 pages (references and appendix not include). It is structured with Introduction (2 pages), Literature review (43 pages), Materials and Methods (24 pages), Results (33 pages), Discussion (46 pages) Conclusion (2 pages), Recommendation (1 pages).

The dissertation consists of 61 tables, 14 diagrams, 37 figures, and 158 references (43 in Vietnamese and 115 in English).

Appendix includes publications, references, questionnaires and patient list.

Chapter 1
LITERATURE REVIEW

1.1. BRIEF SUMMARY OF ANATOMY OF THE STOMACH, RELATIONS AND APPLICATIONS.

Shape of the stomach

The stomach has a J-shape extended toward the upper proportion. The lateral border of the stomach curves toward the right bottom. The average volume of the stomach in adults is about 1500 ml. The stomach has divisions: cardia, fundus, body, and pylorus.

Relations of the stomach

Anteriorily relations

The upper proportion of the stomach locates behind the left thoracic wall, behind ribs VI, VII, VIII, IX, and right below the left dome of the diaphragm. Through the diaphragm, it relates to the pleura and the left lung, heart, and pericardium. To the right side, it relates to the left lobe of the liver.

Posteriorily relations

Fundus-cardia: Relating to the left dome of the diaphragm. There is the gastrophrenic ligament there, thus, this part is less mobile.

The posterior surface of the stomach relates to the lesser sac. Through the lesser sac, the stomach relates to the diaphragm, the left suprarenal gland, the upper part of the front of the left kidney, the splenic artery, the front of the pancreas, the front of the transverse mesocolon. To the left side, the posterior surface of the stomach relates to the spleen and the left part of the transverse colon.

Lesser curvature: There is the lesser omentum attaching to lesser curvature.

Greater curvature:

On the greater curvature, from the top to the bottom, there are the gastrophrenic ligament, gastrosplenic ligament, splenorenal ligament, greater omentum, and the gastrocolic omentum of greater omentum attaching to the greater curvature. Between layers of these ligaments, there are short gastric arteries (upper) and left gastroepiploic arteries connecting to the right gastroepiploic arteries that supply branches to the greater curvature.

Neurovascular supply

Gastric arteries: Arteries supplying blood to the stomach are diverse and are branches of the celiac artery.

Gastric veins: Major veins of the stomach mainly run into the hepatic portal vein.

Two main sources of the nervous system that affect the stomach belong to the autonomic nervous system. They are the sympathetic nerve and parasympathetic nerve.

Lymphatics of the stomach

In 1981, the Japanese Gastric Cancer Association (JGCA) introduced a table dividing lymphatics into 16 categories and 4 lymph node stations. Until 2011,

this classification is modified and added details in which lymph node stations (N) were determined by locations of the tumor.

1.2. DIAGNOSIS OF GASTRIC CARCINOMA.

Clinical symptoms

Clinical presentations

Clinical signs

Systemic symptoms

Para-clinical examinations

Barium enema with a double-contrast image.

Gastric endoscopy.

Endoscopic ultrasound.

Computer tomography (CT)

Histopathological examination: Histopathological examination that is conducted preoperatively provides valuable evidence for a definite diagnosis. Postoperative histopathology contributes to the accurate determination of histopathological morphology and levels of differentiation, levels of invasion, and the metastasis of lymph nodes, thus, helps to determine the stage of cancer. They provide information to plan the supplementary treatments and prognosis.

Stages of gastric carcinoma

Classifications of gastric carcinoma are made consensus by guidelines of the Union for International Cancer Control (UICC) in 2009, of the American Joint Committee on Cancer (AJCC) in 2010, and JGCA in 2011 as follows:

T: Primary tumor

TX: Primary tumor cannot be assessed

T0: Main tumor cannot be found.

Tis: Carcinoma in situ: intraepithelial tumor without invasion of the lamina propria

T1: Tumor invades lamina propria, muscularis mucosae, or submucosa

T1a: Tumor invades lamina propria or muscularis mucosae

T1b: Tumor invades submucosa

T2: Tumor invades muscularis propria

T3: Tumor penetrates subserosal connective tissue without invasion of visceral peritoneum or adjacent structures

T4: Tumor invades serosa (visceral peritoneum) or adjacent structures

T4a: Tumor invades serosa (visceral peritoneum)

T4b: Tumor invades adjacent structures

N: Regional lymph nodes

NX: Regional lymph node(s) cannot be assessed

N0: No regional lymph node metastasis

N1: Metastasis in 1-2 regional lymph nodes

N2: Metastasis in 3-6 regional lymph nodes

N3: Metastasis in seven or more regional lymph nodes

M: Distant metastasis

Mx: Distant metastasis cannot be assessed

M0: No distant metastasis

M1: Distant metastasis

Classifications of gastric carcinoma stages by TNM

	N0	**N1**	**N2**	**N3**	**M1**
T1a, T1b	Ia	Ib	IIa	IIb	IV
T2	Ib	IIa	IIb	IIIa	
T3	IIa	IIb	IIIa	IIIb	
T4a	IIb	IIIa	IIIb	IIIc	
T4b	IIIb	IIIb	IIIc	IIIc	

1.3. INDICATIONS AND CONTRAINDICATIONS OF LTG WITH D2 LYMPHADENECTOMY

Indications:

Patients contracting gastric carcinoma that are impossible to remove mucosa using laparoscopic surgery, and there is no invasion of surrounding organs.

Patients with tumor stage T1 – T4a without distant metastasis.

Patients with TNM ≤ IIIC.

Patients have tumors at the upper stomach, invasion in deep layers of mucosa but it is possible to conserve the spleen in the condition of no lymph node metastasis along the splenic artery.

Being conducted by experienced surgeons.

Contraindications:

Patients have symptoms that are contra-indicated with laparoscopic surgery.

Patients have severe comorbidities. Patients with high BMI values.

Patients have a large gastric tumor, wide invasion that is not safe for dissection.

CHAPTER 2
STUDIED PATIENTS AND METHODS

2.1. STUDY PATIENTS

70 patients that underwent LTG with D2 lymphadenectomy at Nghe An Friendship General Hospital from 07/2017 to 11/2020.

Inclusion criteria:

Patients were made a diagnosis of gastric adenocarcinoma.

Cancer tumors at the two-third upper stomach, with the distance from the tumor margin to cardia < 6cm, or had complete infiltration. Patients had tumors at the greater curvature. The level of invasion was ≤ T4a, and there was no invasion of the esophagus, no distant metastasis.

Tumor stage ≤ IIIc

Patients were treated by LTG with D2 lymphadenectomy.

Patients were explained, agreed to be treated by LTG, and agreed to participate in the study.

Medical records were sufficient following study criteria.

Exclusion criteria:

Patients had tumors at one-third lower stomach, had the level of invasion of T4b, or there was an invasion of the esophagus, tumors at stage IV.

Patients had ASA score > 3, had symptoms of cardiovascular diseases, respiratory diseases, coagulation disorders, severe renal impairment, dementia… or were contra-indicated with laparoscopic surgery.

Patients had a recurrence of gastric cancer or had other types of cancer.

Patients were treated by partially laparoscopic surgery, or LTG with D2+ lymphadenectomy, or D2 lymphadenectomy with removing the spleen, pancreatic parenchyma, the liver in parallel.

Histopathological result after the surgery showed that it was not gastric adenocarcinoma.

Patients were required open surgery transfer right after preliminary examination to evaluate the lesion and the possibility to receive surgery by laparoscopy or by any other reasons (without dissection).

Patients disagreed to be treated by laparoscopic surgery, disagreed to participate in the study.

Medical records are not sufficient by surgical criteria.

2.2. STUDY METHODS

Study design

Observational prospective study, clinical intervention without control from 07/2017 to 11/2020.

Sample size

Using the formula to calculate the sample size:

$$N = \frac{Z^2 (1-\alpha/2)\, p(1-p)}{E^2}$$ where

N: the minimal number of patients

$Z^2 (1- \alpha /2) p(1-p) = 1.96^2$ that is concordant to 95% confidence interval.

E: minimal acceptable standard error, selected E = 0.06

We selected the possibility of success of 95% that is concordant to p = 0.95.

Thus, the minimal sample size is 50 patients.

At the Nghe An Friendship General Hospital from 07/2017 to 11/2020, the study included 70 patients.

Procedure of LTG with D2 lymphadenectomy

Surgical tools:

A standard tool kit of laparoscopic surgery.

Ultrasonic cutting for surgery: For the procedure of hemostasis and dissection.

Unipolar electric knife.

Linear and circular staplers.

Patient preparation:

Patients and their relatives were explained about the disease, planed treatment, surgical procedure, anesthesia and risks during, and after the surgery.

Patient posture and surgical team:

Patients were placed in the supine split-arm and split-leg position.

The main surgeon stands on the left of the patient.

Placing trocars: 5 trocars were placed.

Surgical steps:

Step 1: Examining the tumor and the possibility of surgery.

Step 2: Totally removing the greater omentum, cutting until splenic hilum (to the left) and until the right hepatic flexure (to the right), removing lymph nodes of station 4d.

Step 3: Removing the lymph node station 6 under the pylorus, exposing and ligating the right gastroepiploic vein in front of the Henle's trunk, ligating the right gastroepiploic artery which is next to the branch derived from the gastroduodenal artery. Dissecting and exposing a half area lower the first part (D1) of the duodenum.

Step 4: Totally removing the smaller omentum, cutting until liver hilum (to the right) and until the right border of the esophagogastric junction (to the left), removing lymph node stations 3 and 5, ligating and cutting the right gastric artery at its origin, removing lymph node station 12a of liver hilum area along the common hepatic artery. Dissecting and exposing a half area upper the first part (D1) of the duodenum.

Step 5: Removing lymph node station 8a along the proper hepatic artery, removing lymph node station 7 around left gastric arteries, removing lymph node station 9 around the celiac artery, removing lymph node station 11p at the

surface near the splenic artery. Ligating and cutting left gastric artery and vein at their origin.

Step 6: Removing lymph node station 1, exposing the right side of the cardia and the esophagus from the abdomen to the right crus of the diaphragm.

Step 7: Dissecting gastrosplenic omentum and short arteries, removing lymph node stations 4sb and 4sa. Ligating and cutting short arteries, separating greater curvature from the spleen. Removing lymph nodes station 11d along the distant part of the spleen artery, removing lymph node station 10 along splenic hilar arteries. Removing lymph node station 2 on the left of the cardia, exposing the left side of the cardia from the abdomen to the left crus of the diaphragm. At the same time, mobilizing the abdominal part of the esophagus, and opening a small hole at the right side of the esophagus that was 1-1.5 cm above the cardia.

Step 8: Recovering gastrointestinal circulation following the Roux-en-Y procedure using functional end-to-end anastomosis without previous resection of esophagus and jejunum: Exposing the loop jejunum at a distance of 60 cm from the Treitz angle, examining whether the artery was enough long and able to supply sufficient blood. Releasing the mesentery 3 cm at the mesenteric border and opening a small hole 1 cm at the free border of the jejunum. Placing an anvil of a linear stapler into the hole at the jejunum, hanging the loop jejunum on toward the left side of the esophagus, and placing another anvil of the linear stapler into the hole on the esophagus. Afterward, using a linear stapler to cut across the jejunum and the low part of the esophagus (right above the hole on the esophagus and the jejunum), and closing the anastomosis at the same time. Before resecting and closing the anastomosis, adding air or fluid via a nasoesophageal tube to examine the circulation of the anastomosis. Dissecting the loop jejunum and separating it from the dissected stomach, then moving the stomach to the right, moving the ascending loop (proximal jejunum) to the left and under the descending loop (that connecting with the esophagus), then made a jejunojejunal anastomosis (Roux-en-Y anastomosis) using a linear stapler. Closing the opened mesentery using vicryl suture 3.0.

Step 9: Cutting and closing duodenal cap by a linear stapler at a distance of 1.5 – 2 cm lower the pylorus. Placing the dissected stomach and omentum into a colostomy bag.

Step 10: Flushing and rinsing the abdomen, inserting a drain tube under the liver and spleen. Moving medical waste out via a trocar hole 12 mm. Close all trocar holes.

Study measures:

Characteristics of patients:

Age, gender, geographical characteristics, occupation.

BMI, ASA

Medical history.

History of internal diseases.

History of general diseases.

History of stimulant usage.

Hospital admission: emergency or general.

Gastric carcinoma characteristics:

Clinical symptoms

Clinical signs

Paraclinical examinations: blood test, gastric endoscopy, computed tomography (CT).

Tumor characteristics during the surgery.

Tumor characteristics after the surgery.

Surgical characteristics of technique of LTG with D2 lymph node dissection:

Posture of the patient.

Position of the surgeon.

The number of trocars, the location of trocars, and the size of trocars.

Surgical procedures: totally laparoscopy or assisted-laparoscopy.

Method to recover the gastrointestinal circulation.

Difficulties during the surgical steps stemmed from adhesion, of large tumors, tumors on upper location (at the cardia or near the cardia), a high density of adipose tissue, narrowing of the abdomen, etc.

Surgical Outcomes of LTG with D2 lymphadenectomy:

Operative time (minutes)

Incidents during the surgery.

The volume of blood loss during the surgery (ml)

The number of dissected lymph nodes, the number of metastatic lymph nodes, the location of lymph node stations.

Transfer of open surgery when it is impossible to finish the procedure of laparoscopy due to incidents during the surgery or when the surgical technique is difficult to perform and needs to transfer to open surgery (excluding the reasons relating to tools, devices).

Success of the surgery.

Treatment outcomes after the surgery:

Early outcomes:

Level of patients' pain.

Timing of recovering bowel movement (hour)

Timing of drain removal (hour)

Timing of first diet (day)

Timing of gastric tube removal (hour)

Hospital stay (day)

Complications

Follow-up outcomes after the surgery:

Follow-up period (month)

Health evaluation after the surgery following the Spitzer scale.

Prevalence of recurrence or metastasis after the surgery.

Narrowing of anastomosis after the surgery: swallow choking, narrowing of anastomosis shown by endoscopy.

Supplementary chemotherapy after the surgery.

Survival time after the surgery.

Data collection and handling:

Data collection: Data was collected based on studied medical records.

Data handling: Data was input and handled by SPSS 26.0

Ethics statement:

The protocol was approved by the Committee Protocol Evaluation - University of Medicine and Pharmacy at Hai Phong, and President of Nghe An Friendship General Hospital to ensure the scientific contribution and the feasibility.

The interventions were conveyed to patients so that they voluntarily participated in the study. Patients who disagreed to participate in the study were not discriminated against. Their data was kept secret. Data was collected objectively and honestly.

Collected data was just used for the research purpose.

CHAPTER 3
RESULTS

3.1. CLINICAL AND PARACLINICAL CHARACTERISTICS AND LESIONS OF GASTRIC CANCER AND THE TECHNIQUE OF LTG WITH D2 LYMPH NODE DISSECTION

3.1.1. Gastric carcinoma patients' characteristics in the study

Age: Mean age was 62.47 ± 11.6 years ranging from 29 years to 88 years in which the group of above 60 years accounted for 62.9%.

Gender: 71.4% of patients were males, male/female ratio was 2.5/1.

Geographic characteristics: 91.4% of patients came from rural and mountainous areas, 8.6% of them came from cities, communes, and towns.

Occupation: A majority of patients were farmers (62.9%), followed by retired workers (22.9%).

Medical history: 57.1% of patients previously contracted gastric diseases in which 40% of them presented gastritis and duodenitis, 15.7% of them had a duodenal ulcer, and 1.4% of them suffered from gastrointestinal bleeding caused by gastric and duodenal ulcers.

Comorbidities: 28.6% of patients had internal diseases such as hypertension (12.9%), cardiovascular diseases (2.9%), diabetes (4.3%), bronchitis (2.9%), past tuberculosis, urinary tract infection (5.7%). 4.2% of patients once had general diseases namely surgery of small bowel perforation caused by blunt abdominal trauma (1.4%), surgery of laparoscopic appendectomy (1.4%), surgery of right-hand amputation due to war wound (1.4%).

Classification of diseases by ASA and body mass index by BMI

Health conditions before the surgery and anesthesia resuscitation in the study were mainly ASA1 and ASA2 which accounted for 90%. There were 7 cases accounting for 10% had ASA3. BMI of studied patients showed 85.7% of patients in the normal range, 12.9% of patients were underweight, and 1.4% of patients were overweight.

3.1.2. Clinical characteristics of gastric adenocarcinoma patients

Clinical presentations:

Clinical presentations of patients in the first admission were abdominal pain, loss of appetite, bloating, weight loss that accounted for 100%, 94.3%, 82.9%, and 94.3%, respectively. There were 16 of 70 patients (22.9%) who had symptoms of gastrointestinal bleeding including haematemesis, black stool, or both. The average weight loss was 3.24 ± 0.17 (0-9 kg). There were 97.1% of cases presented epigastric pain, and 2.9% presented pain in the lower left abdomen. The average time of pain was 2.3 ± 2.4 months ranging from 1 month to 12 months in which group of below 1 month accounted for 41.7% and the group of 2-5 months accounted for 44.2%.

Clinical signs: 7.1% of patients were noticed tumors in the left-upper abdomen in the preliminary examination.

3.1.3. Paraclinical characteristics of gastric adenocarcinoma patients.

Average level of red blood count prior to the surgery was 4.4 ± 0.9 (1.5-6.8) million/ml.

Average level of hemoglobin prior to the surgery was 121.7 ± 26.4 (44-175) g/ml.

Gastric carcinoma patients who had blood type O were the majority (48.6%) followed type B (28.6%), type A (18.6%), type AB (4.3%).

Tumor locations of gastric carcinoma were at cardia (5.7%), body (61.4%), antrum (31.4%), and ulcer with completely infiltrated stomach (1.4%).

General endoscopic image of the lesion showed 51.4% of ulcer, 40% of infiltrated ulcer, and 8.6% of a polyp.

There were 92.9% of patients showed gastric wall thickness shown by computed tomography. 44.3% of patients had lymph nodes shown by abdominal computed tomography.

A majority of patients (62.9%) had T3 tumor shown by CT. 64.3% of patients did not have migrated lymph nodes shown by CT, 24.3% of cases (17 patients) were in stage N1, 11.4% of cases (8 patients) were in N2 and no patients in N3.

Table: Stage gastric adenocarcinoma of CT according to TNM:

Stage TNM		**Patients (n = 70)**		**Ratio (%)**	
I	Ia	19	12	27.1	17.1
	Ib		7		10.0
II	IIa	42	25	60.0	35.7
	IIb		17		24.3
III	IIIa	9	6	12.9	8.6
	IIIb		3		4.3

27.1% of patients were in stage I, 60% were in stage II, and 12.9% were in stage III.

3.1.4. Characteristics of gastric adenocarcinoma during the surgery.

50% of patients had normal gastric serosa, 44.3% of patients had gastric serosa with unusual color (ivory-white) in T3, and 5.7% of patients had gastric serosa transformed tumors (T4a).

Position of tumors during the surgery: 11.4% at the cardia, 82.9% at the body, 4.3% at the antrum, and 1.4% of ulcers with the completely infiltrated stomach.

The percentages of the studied patients who had size of lesion < 3 cm, 3-5 cm, and > 5 cm were 2.9%, 68.6%, and 28.6%, respectively. The average size of the lesion was 4.74 ± 1.56 cm.

The distance from the gastric lesion to cardia was 2.98 ± 0.85 cm on average.

The distance from the gastric lesion to the upper resection line was 4.9 ± 0.9 cm on average.

3.1.5. Characteristics of pathological gastric adenocarcinoma.

80% of patients presented adenocarcinoma, 15.7% of patients presented ring cell adenocarcinoma, and 4.3% of patients presented mucous gland adenocarcinoma.

Level of invasion in stages T1, T2, T3, T4a were found in 8.6%, 18.6%, 64.3%, and 8.6% of patients, respectively.

There were 51.4% of patients with no metastatic lymph node (N0), 14.3% of patients having metastatic lymph node station N1, 17.1% of patients having metastatic lymph node station N2, and 17.1% of patients having metastatic lymph node station N3.

Lymph node stations 1 (42.9%), 2 (12.9%), 3 (42.9%), 4 (28.6%), 7 (20%), and 8 (12.9%) were highly possible to migrate in gastric adenocarcinoma patients and needed totally laparoscopic total gastrectomy. No metastatic lymph nodes were observed in stations 10 and 12.

Gastric adenocarcinoma at stages I, II, and III were respectively 21.4%, 45.7%, and 32.8%.

3.1.6. Surgical outcomes of technique of LTG with D2 lymphadenectomy.

100% of patients were placed at the center with split-arms and split-legs posture. Surgeons stood on the left of the patient.

100% of cases needed five trocars in which there was one of 10 mm trocar, one of 12 mm trocar, and three of 5 mm trocars.

The success rate of LTG with D2 lymphadenectomy was 100%. 100% of patients recovered their gastrointestinal circulation using Roux-en-Y procedure and were made functional end-to-end jejunojejunal anastomosis without previous resection of esophagus and jejunum.

There were 10% of cases that were difficult to perform the surgery.

3.2. Study outcomes of LTG with D2 lymphadenectomy

3.2.1. Surgical outcomes:

The number of dissected lymph nodes was 23.2 ± 6.7 on average.

The number of metastatic lymph nodes was 2.77 ± 3.8.

100% of the upper resection line and lower resection line revealed no cancer cell.

Average blood loss during the surgery was 32.29 ± 10.09 ml.

The average operative time was 202.2 ± 28.9 minutes.

Table: Complications in surgery

Complications in surgery	Patients (n = 70)	Ratio (%)
Injured spleen	1	1.4
Injured liver	1	1.4
Injured small intestine	1	1.4
No complications in surgery	67	95.7

There were 4.2% of cases having incidents during the surgery in which one case with damaged and torn spleen, one case with injured liver parenchyma, and one case with serosal laceration of the small intestine. There was no case requiring open surgery transfer or no postoperative death.

The operative time on group of < 5.5 cm in size of tumors was shorter than the group of ≥ 5.5 cm in size. This difference was statistically significant ($p<0.05$).

The numbers of dissected lymph nodes in the group of gastric adenocarcinoma stage I and II were fewer than the group of stage III. These differences were statistically significant ($p<0.05$).

The number of metastatic lymph nodes in the group of gastric adenocarcinoma stage I and II was much fewer than the group of stage III. These differences were statistically significant ($p<0.05$).

The volume of blood loss during the surgery was fewer in the group of dissected lymph nodes <21 compared to the group of dissected lymph nodes ≥21. This difference was statistically significant ($p<0.05$).

3.2.2. Treatment outcomes after the surgery

Early outcomes

The findings showed 60% of patients suffering from mild pain, 40% of patients suffering from moderate pain. There was no case with severe pain or very severe pain. The time requiring pain relief was 2.3 ± 0.5 days.

The timing of the first flatus after the surgery was 48.6 ± 13.1 hours.

The timing of gastric tube removal after the surgery was 22.4 ± 26.8 hours ranging from 0 to 96 hours.

The timing of drain removal was 3.1 ± 1.4 days.

The hospital stay was 7.3 ± 1.9 days ranging from 5 to 13 days.

Table: Complications after surgery

Complications	Patients (n = 70)		Ratio (%)	
No complications	67		95.7	
Pneumonia	3	1	4.2	1.4
Residual abscess		1		1.4
Infectious incision		1		1.4

The study found the incident rate was 4.2%. There was one case of pneumonia, one case of infectious incision at trocar hole 12 mm where collecting medical waste, and one case of residual abscess after the surgery.

Follow-up outcomes after the surgery.

In the study, 100% of patients were followed up until the end of the study in which 61 patients directly visited the hospital. Their data was collected following an available studied form. There were 9 patients who gave studied data via mobile phone. The follow-up period was 20.83 ± 1.2 months (7-46 months).

1-month after the surgery, 100% of patients had a moderate health condition.

6-months after the surgery, 98.6% of patients had a good health condition.

1-year after the surgery, 98.2% of patients had a good health condition.

2-years after the surgery, 72.1% of patients had a good health condition.

3-years after the surgery, 73.7% of patients had a good health condition.

The results of patients visiting the hospital as planned found three cases (4.3%) having shallow choking (narrowing of anastomosis) 6-months after the surgery. There was no case requiring endoscopic dilation or re-surgery.

The study observed 14 cases (20%) relapsed and had metastasis after the surgery. The timing of recurrence and metastasis was 18.6 ± 6.8 months (8-36 months).

There were also 50 patients demanding supplementary chemotherapy after the surgery with XELOX (xeloda and oxaliplatin) scheme, EXO (epirubicin, oxaliplatin, capecitabine) scheme, and capecitabine.

Survival rates after the surgery.

Overall survival time was 40.14 ± 1.73 months (36.745-43.536 months).

Survival time without disease was 35.71 ± 2.33 (31.14-40.27) months.

Survival time with the disease was 6.44 ± 0,96 (4,57-8.32) months.

Excess 1-year, 2-years, 3-years survival rates of the group of stage I, II and III compared to the group of stage III were respectively 100% vs 95.7%, 94.3% vs 86.1%, and 82.6% vs 51.7%.

Using log-rank test and multivariate analysis (Cox model) analysis, we found that only the postoperative recurrence of the tumor was associated with survival time after the surgery. This relationship was statistical significant ($p<0.05$). Other factors showed no relationship with the time to survival after the surgery ($p>0.05$).

CHAPTER 4
DISCUSSION

4.1. CLINICAL AND PARACLINICAL CHARACTERISTICS AND LESIONS OF GASTRIC CANCER AND THE TECHNIQUE OF LTG WITH D2 LYMPH NODE DISSECTION

4.1.1. Patients' characteristics.

Age: Mean age was 62.47 ± 11.6 years ranging from 29 years to 88 years in which the group of above 60 years accounted for 62.9%. The mean age reported by Japanese authors was 62.7-64.8 years, by European and American authors was 63.6-73.0 years.

Gender: There were 20 females in the studied participants that accounted for 28.6%, and 50 males that accounted for 71.4%; the male/female ratio was 2.5/1. A large proportion of studies published by authors in Vietnam or other countries showed that gastric carcinoma occurred in males more commonly than females.

Geographic characteristics: A majority of patients came from rural and mountainous areas (64 patients, 91.4%), only 8.6% of patients came from cities.

Occupation: Most of the patients were farmers (62.9%), followed by retired workers (22.9%). Workers and other occupations (housewife, etc.) accounted for the lowest percent (2.9%).

Medical history: Gastric carcinoma often onsets from patients' primary pathology derived from gastro-duodenum. In the study, there were 57.1% of patients previously contracted gastric diseases of which 40% of them relating to inflammation, 15.7% of them relating to the ulcer, and 1.4% of them presented gastrointestinal bleeding. The study results indicated 28.6% of patients had internal diseases such as hypertension (12.9%), cardiovascular diseases (2.9%), diabetes (4.3%), bronchitis (2.9%), past tuberculosis, urinary tract infection (5.7%). These diseases were treated and patients were not contra-indicated with laparoscopic surgery.

Classification of diseases by ASA and body mass index by BMI

In our study, health conditions before the surgery and anesthesia resuscitation in the study were mainly ASA1 and ASA2 which accounted for 90%. There were 7 cases accounting for 10% had ASA3. BMI of studied patients was 20.53 ± 2.04 kg/m^2. This value reported by European authors was 22.3-25.0. Whether body mass index affects the studied outcomes depends on the experience, profession, and skill of surgical manipulations of surgeons. If BMI is low in patients with a small body, it obviously affects the surgery, and low BMI means these patients had malnutrition, thus, the prevalence of postoperative complications would higher.

4.1.2. Clinical characteristics of gastric carcinoma

Clinical characteristics of gastric adenocarcinoma are often not specific even when patients are late hospitalized. According to the authors, common symptoms are abdominal pain, bloating, loss of appetite, indigestion, weight loss. Results of this study showed that patients presented abdominal pain (100%), loss of appetite (94.3%), bloating (82.9%), weight loss (94.3%) when

admitting the hospital. There were 22.9% had symptoms as haematemesis, black stool, or both. The average weight loss was 3.24 ± 0.17 kg. The average time of pain was 2.3 ± 2.4 months. We also found that 5 patients (7.1%) were noticed tumors in the preliminary examination. This result is similar to that of Dang Van Thoi (6%) but is lower than that of Do Trong Quyet (9.5%) and Nguyen Lam Hoa (17.8%).

4.1.3. Para-clinical characteristics of gastric adenocarcinoma

Our study showed that the prevalence of blood type O was higher in gastric adenocarcinoma patients with 48.6%, followed by type B, type A, and type AB with 28.6%, 18.6%, and 4.3%, respectively. The average red blood count prior to the surgery was 4.4 ± 0.9 million/ml. The average hemoglobin prior to the surgery was 121.7 ± 26.4 g/ml.

The locations of the tumor were as follows: at cardia (5.7%), at the body (61.4%), at antrum (31.4%), and ulcer with completely infiltrated stomach (1.4%). The size of lesions was 4.7 ± 1.55 cm on average. Location and size of lesions are contributing factors that affect the indication of LTG. If the tumor is too large, it is not safe to conduct a laparoscopic surgery. If the tumor occurs on the pyloric antrum, the indication of removal of the lower half part is more often. General endoscopic images of lesions showed 51.4% of injuries were ulcer, 40% were infiltrated ulcer, and 8.6% were polyp. Most of the authors in Vietnam showed that ulcer was the major lesion and accounted for above 50% of general endoscopic images in gastric cancer patients.

Characteristics of gastric carcinoma patients shown by CT indicated that a large proportion of patients had gastric wall thickness (92.9%). There were 31 patients (44.3%) who had lymph nodes in the abdomen. There were 62.9% of patients had tumors invading the gastric wall classified as T3. There were 7.1% of cases that were suspected as Tis. 64.3% of cases did not have metastatic lymph nodes, 24.3% of cases were in N1, 11.4% of cases were in N2, and no patients were in N3. Following the TNM classification, there were 27.1% of patients classified as stage I, 60% of cases classified as stage II, and 12.9% of cases classified as stage III. CT is a necessary tool that contributes to the diagnosis and prognosis of gastric carcinoma prior the surgery.

4.1.4. Gastric carcinoma characteristics during the surgery.

Our findings showed 50% of patients had normal gastric serosa, 44.3% of patients had gastric serosa with unusual color (ivory-white) in T3, and 5.7% of patients had gastric serosa transformed tumors. Other authors such as Jung JJ also indicated that the prevalence of T3, T4 in patients were 50%, 3%, respectively. These values reported by Bruno Zilberstain were 48% in T3, and 6% in T4.

Regarding the positions of the tumor during the surgery, we found that 11.4% of them located at the cardia, 82.9% at the body, 4.3% of the antrum, and 1.4% of ulcers with the completely infiltrated stomach. These percentages were different from that shown by preoperatively endoscopic results and were significant ($p < 0.05$). These differences depended on the profession, experience, and skill of physicians and endoscopic technicians as well as

endoscopic devices. The surgical results were usually more exact because surgeons must observe lesion conditions and examine medical specimens at the same time so that they could study and evaluate them postoperatively.

The average size of lesions was 4.74 ± 1.56 cm. This result was smaller than that of other authors. In particular, Nguyen Quang Bo revealed the average size of lesion of 5.38 ± 1.88 in his study while Vu Hai reported that tumors with the size of lesion <5 cm accounted for 23.6% and that ≥5 cm accounted for 76.6%. That means most patients underwent surgery at a late stage.

The distance from the gastric lesion to the cardia was 2.98 ± 0.85 cm on average. The detection of the distance between the upper resection line and cardia helped surgeons select appropriate interventions (total gastrectomy or partial gastrectomy). Based on studies of the distance between the upper resection line and the cardia, and to ensure rules of cancer cure, we recommended that if the distance between the upper resection line and the cardia was < 6 cm, it should select total gastrectomy. If this distance was ≥ 6 cm, it should select partial gastrectomy.

The distance between the upper border of the gastric lesion to the upper resection line was 4.9 ± 0.9 cm on average. The detection of the distance between the upper border of the gastric lesion to the upper resection line helped select the method of anastomosis production using circular staplers or linear staplers. According to Le Minh Son, the dissected gastric part must be at least 6-8 cm above the tumor. For tumors at the body and cardia-fundus parts, it should select total gastrectomy. To prevent the recurrence of cancer at anastomosis position, the newest recommendations of JGCA and AJCC stated that this distance should be at least 5 cm.

4.1.5. Characteristics of pathological gastric adenocarcinoma

Our findings indicated that 80% of patients presented adenocarcinoma, 15.7% of patients presented ring cell adenocarcinoma, and 4.3% of patients presented mucous gland adenocarcinoma. There were 58.6% of gastric adenocarcinoma cases showing poor differentiation, 37.1% showing moderate differentiation, and 4.3% showing high differentiation. According to JGCA, adenocarcinoma is the most popular followed by squamous cell adenocarcinoma, poor differentiation cancer, ring cell adenocarcinoma, and mucous gland adenocarcinoma.

In our study, the level of invasion in T1, T2, T3, T4a were found in 8.6%, 18.6%, 64.3%, and 8.6% of patients, respectively. There were no cases of T0, Tis, and T4b.

With regards to lymph node stations, there were 51.4% of patients without metastatic lymph node (N0), 14.3% of patients having metastatic lymph node station N1, 17.1% of patients having metastatic lymph node station N2, and 17.1% of patients having metastatic lymph node station N3. The rate of metastatic lymph node stations in our study was lower than that of other authors (Nguyen Cuong Thinh, Le Van Thanh, Do Trong Quyet). Different rates between our and other's studies may come from the difference in sample size, participants, and clinical stages.

Concerning metastatic lymph node stations, we recorded that lymph node stations located on half above of the stomach such as 1 (42.9%), 2 (12.9%), 3 (42.9%), 4 (28.6%), 7 (20%), and lymph node station 8 (12.9%) had a high metastatic rate in gastric adenocarcinoma patients requiring LTG. No metastatic lymph node was observed in stations 10 and 12. The report of Dang Van Thoi showed that common lymph node stations were 4, 6, 3, 5. Over two decades, based on clinical trials and sufficiently large and reliable sample sizes, authors in Japan proved that metastatic lymph node station is an important factor in the prognosis of gastric cancer. Thus, it confirmed the advantage of lymphadenectomy in the extension of the life span of patients. Excess 5-years survival time after D2 lymphadenectomy surgery was 50% compared to 30% induced by D1 lymphadenectomy.

Gastric adenocarcinoma at stages I, II, and III were respectively 21.4%, 45.7%, and 32.8%. Those results showed that patients in our study were hospitalized early than in other studies. This can be explained by the differences between the study period, sample size, and studied participants. In developed countries, patients were noticed their disease earlier, therefore, the postoperatively survival rate was also higher.

4.1.6. Surgical outcomes of technique of LTG with D2 lymphadenectomy

100% of patients lied at the center with outstretched arms 30-45^{o} and split-legs. Surgeons stood on the left of the patient. 100% of cases needed 5 trocars.

The position of surgeons and the number of trocars were different between studies. Most of the authors reported that the surgeon standing between two legs of patients while Vo Duy Long reported that the surgeon standing on the right side of the patient. Strong VE also used five trocars in the LTG with D2 lymphadenectomy and the surgeon stood on the right.

All authors made a consensus that the patient would lie down with a split-legs posture, but there are differences between the angle of outstretched legs. Regarding the position of the surgeon, the number of trocars, and the size of trocars, there were differences between studies. These differences came from health education, the conventional degree of surgeons, and instruments.

The success rate of LTG with D2 lymphadenectomy in our study was 100%. There was no case receiving assisted-laparoscopic surgery, no death during the surgery, and in the follow-up period. 100% of patients recovered their gastrointestinal circulation using the Roux-en-Y procedure and were made functional end-to-end jejunojejunal anastomosis without previous resection of esophagus and jejunum using a linear stapler. The procedure was conducted absolutely in the abdomen. Ebihara Y et al. recovered the gastrointestinal circulation by functional end-to-end jejunojejunal anastomosis using linear stapler 45 mm in 65 patients. Results of this study showed 1.5% of patients having an anastomotic leak, 4.6% of patients having narrowing of esophagojejunal anastomosis, and 4.6% of patients having complications relating to esophagojejunal anastomosis during making the anastomosis. For

example, the linear stapler connected with a gastric tube, or loop jejunum was reversely connected.

The basic technical procedure was similar between studies in Vietnam and other countries. The difference was just how steps are combined. In particular, Vo Duy Long divided the procedure into seven steps, but other authors combined these seven steps into one step. Our procedure is similar to that reported by Do Van Trang which had 10 steps. However, we made some appropriate modifications such as: (1) the surgeon stood on the left, (2) cut and closed duodenal cap, (3) made functional end-to-end jejunojejunal anastomosis without previous resection of esophagus and jejunum using a linear stapler.

Following surgical procedures, we realized that most procedures of LTG with D2 lymphadenectomy are conventional. There were 10% of cases that we had trouble when examining the tumor (step 1) because the greater omentum adhered to the abdominal wall and liver at the upper abdomen after the previous surgery of small bowel perforation caused by blunt abdominal trauma. After removing the greater omentum from the abdominal wall, all next steps were done smoothly. There were two cases having large mobilized tumors (T4a) at the center of less omentum. Thus, the emergence of tumors caused cumbersome manipulation when dissecting lymph node station 12a (step 4). We dissected the cardia, esophagus, and omenta in order to mobilize the stomach toward the right side. That helped the lymphadenectomy at step 4 more conventionally. There was one large tumor very near the cardia, but it had not invaded the esophagus. This tumor caused difficulty in step 8 when the esophagus was connected to the jejunum. In this case, we mobilized the esophagus upon the diaphragm in order to extend the abdominal esophagus, and thus, it was easier to connect the esophagus and jejunum by linear stapler. There were also two cases of narrowing of the abdomen because of patients' small and lean bodies (BMI = 14.7 and 16.5). Also, there was one woman with a high density of adipose tissues in the abdomen that caused difficulty in manipulations. Nevertheless, there were no incidents during the surgery.

4.2. Study outcomes of LTG with D2 lymphadenectomy

4.2.1. Surgical outcomes

The number of dissected lymph nodes was 23.2 ± 6.7 on average. The average number of metastatic lymph nodes was 2.77 ± 3.8. 100% of the upper resection line and lower resection line revealed no cancer cell (R0). Dang Van Thoi showed in his study that the average number of dissected lymph nodes was 6.22 ± 3.2. Le Manh Ha, Nguyen Xuan Kien, Vo Duy Long, and Kim EY reported this number was 15, 5.26 ± 5.62, 25.1, and 38.3 ± 14.2, respectively.

The average volume of blood loss during the surgery was one factor evaluating the safety and success of the surgery. If the volume of blood loss in excess, this surgery is not enough safe and could cause incidents and complications. Our study showed this value of 32.29 ± 10.09 ml. The volume of blood loss was different between studies. According to Shinohara T, this number was 102 ml while Lee JH showed 150 ml. Kyogoku N reported that the

average volume of blood loss was 100 ml and 23 ml using a circular stapler and linear stapler, respectively.

Important factors relating to the operative time were the profession, experience, and skill of surgeons, and the smooth cooperation of surgical team. Our study reported the average operative time was 202.2 ± 28.9 minutes (145-270 minutes), of which 81.4% of cases had the operative time ranged from 170-240 minutes. There were three cases (4.3%) that had long operative time (>240 minutes), of which one had an operative time of 250 minutes. This patient was lean (BMI = 16.5 kg/m^2) and had narrowing of the abdomen. There was also one case having an operative time of 245 minutes. This patient was female and had a high density of adipose tissue in the abdomen despite her BMI was of the normal range. There was one case with 270 minutes of operative time because of the large tumor with the invasive level of T4a. Vo Duy Long (2017) and Chang KK (2017) also recorded the mean operative time of 226 ± 25.3 and 266 minutes, respectively.

Some factors relating to the operative time noted in literature were the experience of gastrectomy and lymphadenectomy when conducting open surgery of the surgeons, their learning curve, the good cooperation of surgeons during the surgery, and the habit of tools usage of surgeons. These factors contribute to the reduction of operative time. Based on our experience, the accuracy in the dissection of each anatomical layer and well performance of hemostasis, the good cooperation of surgeons and assistant surgeons, camera assistants, surgical assistants, the supporters outside the surgery would reduce significantly the operative time.

In our study, there were three mild incidents during the surgery accounting for 4.2%, of which one had damaged and torn spleen, one had injured liver parenchyma when hanging liver membrane and causing hemorrhage. These two cases were controlled and stabilized by a hemostatic procedure. There was one case with serosal laceration of the small intestine when recovering gastrointestinal system. We sewed the serosal laceration using X-shape vicryl suture 4.0 of laparoscopic surgery. There was no case requiring open surgery transfer and no postoperative death. Vo Duy Long revealed two incidents during the surgery accounting for 1.8%, while Do Van Trang reported an incident rate of 8.6%.

4.2.2. Treatment outcomes after the surgery

Early outcomes:

The findings showed that there were 60% of patients suffering mild pain, 40% of patients suffering from moderate pain. There was no case with severe pain or very severe pain. The pain relief time was 2.3 ± 0.5 days. These are benefits of the totally laparoscopic total gastrectomy because of the small incision, small force putting on the muscle of the abdominal wall. Therefore, patients suffered less pain and well recovered their physical health. Because of that, LTG with D2 lymphadenectomy can also be applied for the elderly. In our

study, there were five cases of over 80 years and 14 patients of above seven years. All recovered the health early and were stable when discharging.

The timing of the first flatus after the surgery was 48.6 ± 13.1 hours. Ebihara Y et al. reported this value of 1.9 days. Vo Duy Long reported this value of 3.2 ± 0.9 days. According to Kim EY, the time of the first flatus in the totally LTG group and assisted-laparoscopic group were 3.0 ± 0.9 and 3.2 ± 0.7 days.

Timing of gastric tube removal after the surgery was 22.4 ± 26.8 hours ranging from 0 to 96 hours.

The timing of drain removal was 3.1 ± 1.2 days.

The timing of the first diet in our study was 3.7 ± 1.4 days on average. There were 31.4% of patients who received diet on the second postoperative day, 17.1% of them received diet on the third postoperative day, and 11.4% of them on the sixth postoperative day. Chang KK stated that if there was no abnormal progress during the treatment, patients could use soft food on the third postoperative day. Jeong O allowed patients to eat soft food after the total laparoscopic total gastrectomy on the first or second postoperative day. The benefits of early allowance of diet after the surgery for general health and gastrointestinal system were affirmed by many studies in Vietnam and other countries. The early diet after the surgery does not increase or decrease the anastomotic complications postoperatively, but it also helps reduce stress after the surgery and early recovery of health conditions in patients after the surgery. The hospital stay was 7.3 ± 1.9 days ranging from 5 to 13 days.

The study found the incident rate was 4.2% of which one of bronchitis, one of infectious incision at 12-mm trocar hole collecting medical waste, and one of residual abscess after the surgery. In the case of a residual abscess, patients presented epigastric pain, fever on the fifth postoperative day. The ultrasound found a heterogeneous fluid in the abdomen at the epigastric area with 3.3 x 2.5 cm in size. We removed the fluid under the ultrasound guide and collected about 100 ml. After fluid drain, patients were internally treated and stable when discharging. In the case of an infectious incision at 12-mm trocar hole, we cut the incision at the location collecting medical waste and opened it, then changed the dressing twice a day. When the incision was stabilized, we sutured the incision and allowed patients to discharge. There were no incidents of esophagojejunal anastomotic leak, jejunojejunal anastomotic leak, duodenal cap leak, or re-operation due to complications.

There were no differences of complications between groups of ages, level of lymph node migration, gastric tube establishment, hospital stay, postoperative pain levels, level of differentiation of cancer cells, and incidents during the surgery ($p > 0.05$). There were differences in hospital stay relating to gastric tube establishment, the timing of the first diet after the surgery, histopathological type, postoperative complications.

Follow-up outcomes after the surgery:

Narrowing of anastomosis after the surgery: Among patients who visited the hospital as planned, there were three cases (4.3%) having shallow chocking

(narrowing of anastomosis) 6-months after the surgery. There was no case requiring endoscopic dilation or re-surgery. These incidents may be caused by the procedure of cutting the esophagus and jejunum. This procedure was conducted at the same time closing the anastomosis, thus, pulling the anastomosis toward the bottom and reducing space of the anastomosis. Another reason could be the dissection was started at a high position at the chest, thus, caused a lack of oxygen or damaged a part of the nervous system. This resulted in movement disorders at the end of the esophagus, thus, caused shallow choking.

Recurrence and migration after the surgery: The study observed 20% of cases relapsed and had migration after the surgery. The timing of recurrence and metastasis was 18.6 ± 6.8 months (8-36 months). There was one case relapsing at the esophagojejunal anastomosis accounting for 1.4%, one case had bone metastasis accounting for 1.4%. Liver metastasis was the most popular reported by five patients accounting for 7.2% followed by peritoneal metastasis observed in four cases accounting for 5.7%, and lung metastases in three cases (4.3%). The recurrence rates reported by Asian authors ranged from 0.3 to 1.7%. The metastasis rate ranged from 4.5 to 15%. European authors had a higher rate of metastases ranging from 13.3 to 37.9%.

Survival time after the surgery:

Overall survival time was 40.14 ± 1.73 months.

Excess 1-year, 2-years, 3-years overall survival rate were 98.6%, 92.1%, and 75.9%, respectively. Excess 1-year, 2-years, 3-years overall survival rate with the disease were 92.9%, 68.8%, 34.4%, respectively.

Excess 1-year, 2-years, 3-years overall survival rate in the stage I group were 100%, 100%, and 88.9%, respectively.

Excess 1-year, 2-years, 3-years overall survival rate in the stage II group were 100%, 91.8%, and 79.6%, respectively.

Excess 1-year, 2-years, 3-years overall survival rate in the stage III group were 95.7%, 86.1%, and 51.7%, respectively.

We analyzed factors to study whether any factors had a relationship with the overall survival rate after the surgery. The results showed that only the recurrence was associated with the overall survival rate. This result was statistically significant ($p<0.05$).

A study of Kyogoku N in 379 patients undergoing LTG showed that the excess 5-year survival rate was 81.2%, of which excess 5-year survival rates in stage I, stage II, stage III groups were 94.0%, 77.1%, and 43.9%, respectively,

Li Z et al. studied 296 patients undergoing LTG in the treatment of gastric carcinoma showed an excess 5-year overall survival rate of 60.5%, an excess 5-year survival rate without disease of 57.4%. The results also indicated that the excess 5-year overall survival rate and excess 5-year overall survival rate without disease were 89.4% and 85.1% (stage IB), 66.4% and 63.9% (stage II), 44.6% and 41.5% (stage III), respectively.

CONCLUSION

Our study in 70 gastric adenocarcinoma patients undergoing LTG with D2 lymphadenectomy from 07/2017 to 11/2020 gave conclusions as follows:

1. Clinical and paraclinical characteristics and lesions of gastric cancer of patients applying the technique of LTG with D2 lymphadenectomy:

- Mean age of patients was 62.47 ± 11.6 years.
- Common symptoms: 100% abdominal pain, 94.3% loss of appetite, 94.3% weight loss.
- Location of tumor: 11.4% cardia, 82.9% body, 1.4% ulcer with completely infiltrated stomach.
- Size of tumor: 4.74 ± 1.56 cm on average.
- 58.6% of gastric carcinoma were poor differentiation, 37.1% was moderate differentiation, 4.3% was strong differentiation.
- Level of invasion in T3 was the most popular accounting for 64.3%.
- 51.4% of cases observed no metastasis (N0), 14.3% of cases in N1, 17.1% of cases in N2, and 17.1% of cases in N3.
- Lymph node stations that had a high rate of metastasis were 1, 3, 4, 7.
- Gastric carcinoma in stage II was the most common (45.7%), followed by stage III (32.8%).
- 100% of patients underwent totally LTG D2 lymphadenectomy.

2. Study outcomes of LTG with D2 lymphadenectomy

- Success rate of totally LTG D2 lymphadenectomy was 100%.
- Number of dissected lymph nodes was 23.2 ± 6.7 (15 – 45).
- Number of metastatic lymph nodes was 2.77 ± 3.8.
- 100% of upper and lower resection line observed no cancer cell.
- The average volume of blood loss was 32.29 ± 10.09 ml.
- The average operative time was 202.2 ± 28.9 minutes.
- Incident rate was 4.2% and no death case.
- The average length of hospital stay was 7.3 ± 1.9 days (5 – 13 days).
- Postoperative complication rate was 4.2%.
- 20% of cases had recurrence and metastasis. Time to observe was 18.6 ± 6.8 months.
- The overall survival rate was 40.14 ± 1.73 months.
- The excess 1-year, 2-year, 3-year survival rates were 98.6%, 92.1%, 75.9%.

RECOMMENDATIONS

Our study in 70 gastric adenocarcinoma patients undergoing LTG with D2 lymphadenectomy gave recommendation as follow: Educating LTG with D2 lymphadenectomy, the technique of functional end-to-end esophagojejunostomy without previous resection of esophagus and jejunum using linear stapler in the treatment of gastric adenocarcinoma at health centers that have sufficient devices and trained surgeons of laparoscopic gastrectomy or advanced laparoscopic gastrectomy under the program of advanced technique transfer.