

The Outcomes Of Laparoscopic Distal Gastrectomy With D2 Lymphadenectomy For Gastric Cancer In Hanoi Medical University Hospital

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Summary

Purpose: To evaluate the outcomes of laparoscopic distal gastrectomy for gastric cancer in Hanoi Medical University Hospital.

Methods: Retrospective, descriptive study on 62 patients with gastric cancer treated in Hanoi Medical University Hospital from January 2015 to December 2017. The mean age was 57.02 ± 9.1 years with a male to female ratio of 5/3. The position of lesion was 100% in antrum. The disease stages which were observed in gastric cancer patients were mostly pT3 with proportion of 82.3%.

Results: The average operating time was 259 ± 44 minutes and the intraoperative blood loss was calculated as 110.0 ± 23.0 ml. The time to first flatus and postoperative hospital stay were found to be 3.6 ± 1.3 and 11.8 ± 2.6 days. Postoperative complications occurring in the study include intra-abdominal bleeding, anastomosis bleeding, early intestinal obstruction and pneumonia with the same rate of 1.6%. The disease-free survival rate at 3 years was 83.8% while the overall survival rate at 3 years was 81.5% and the overall survival was estimated 33.6 ± 20.6 months.

Conclusion: Laparoscopic distal gastrectomy of gastric carcinoma shows good outcomes with low complication rate and enhanced postoperative recovery. A prospective randomized control on a larger scale is needed to establish the value of laparoscopic gastrectomy.

Key words: Gastric cancer, laparoscopic distal gastrectomy, surgical outcome.

Introduction

Gastric cancer (GC) represents the 5th most commonly diagnosed cancer and is the third leading causes of cancer-related death worldwide [1-2]. Besides, age-standardized incidence rates of gastric cancer are twice higher in men [3]. The geographical distribution of gastric cancer is differentiated by wide international variation. In developing countries there are more than 70% of cases detected, and half of world's GC occurrence is in Eastern Asia [4].

Identification the sources and drivers of economic growth is a fundamental problem in growth and development theory. "Without considering their nature, it is first necessary to single out external and internal sources" [1]. One such source(s) which may be internal, as we see it, workforce productivity.

Globally, laparoscopic gastrectomy (LG) has now been accepted as a new trend of treatment for gastric cancer. Numerous randomized trials, non-randomized trials and meta-analyses have demonstrated LG to be safe and feasible, with advantages such as minimal invasion, less pain, early recovery, and comparable oncological outcomes in comparison with open gastrectomy [5]. However, the surgical and oncologic validity of laparoscopy gastrectomy for treatment of gastric cancer remains controversial and needs to be studied more for its technical difficulty and inadequacy of long-term results.

In Vietnam, gastric cancer is frequent malignant neoplasm and annually influences over 11.000 cases. Furthermore, it ranks second after lung cancer in male and third after breast, cervix cancer in female, and is responsible for approximately 8.000 deaths per year [6]. Although laparoscopic gastrectomy has been applied in recent years and showed very encouraging initial results, there is still limited data that assess this new treatment method of gastric cancer. Hence, we conduct this study with the aim to evaluate the outcomes of laparoscopic surgical treatment for gastric cancer in Vietnam patients.

Method

Study design

This was a retrospective, descriptive study conducted in Hanoi Medical University Hospital from January 2015 to December 2017.

Patients

Patients diagnosed with stage I-III gastric carcinoma on preoperative endoscopic biopsy without contraindication to laparoscopic surgery were eligible for this study. Patients are excluded if they meet any of the following criteria: undergoing any of gastrectomy surgeries previously due to ulcer, perforation or other cancer; any of severe chronic or acute diseases that potentially cause fatal in a short time; receipt of preoperative chemotherapy; evidence distant metastasis. Patients were informed about the possible complications of the procedure and advantages and disadvantages of laparoscopic surgery in comparison

with open gastrectomy. Written informed consents were collected from all participants before their operation.

Study Process

Patients who meet selection criteria were performed hepatic function test prior to surgery including abdominal scan, chest X-ray, CEA, CA 72.4 and anesthesia. Disease staging was determined in accordance with 8th edition of the International Union against Cancer (UICC) TNM classification of malignant tumors [7].

Under general anesthesia the patient was placed in supine position; the surgeon and the endoscopist stood on the right side of the patient while the assistant stood on the left side. A total of five operating trocars were used; One 10 mm trocar was introduced for camera port, two 12 mm trocars were introduced in the left and the right lower quadrants, and two 5 mm trocars were inserted in the left and the right upper quadrants. Laparoscopic exploration was performed by creating first a pneumoperitoneum using CO₂ maintaining at a pressure of 12 mmHg. Lymph node dissection was done using the LigaSure or harmonic scalpel. Distal gastrectomy was performed in accordance with tumor location, size and depth of invasion and make sure that no involvement of the proximal and distal margins, D2 lymphadenectomy was undertaken following to the rules of the Gastric Cancer Treatment Guidelines 2011 by the Japanese Gastric Cancer [8]. After the end of the stomach release and D2 lymphadenectomy, cut and close the duodenum by linear stapler (Echelon 60mm), we make a 5cm median incision under the sternum through the linea alba to bring the stomach out the abdomen, an extracorporeal gastrojejunostomy following Billroth II gastrectomy using linear stapler (GIA™ 75mm) to save costs for patients. Patients were evaluated surgical outcomes which include blood loss, operation time, postoperative complications, length of postoperative hospital stay, all recorded by the surgeon.

Adjuvant chemotherapy was given to patients who is in stage I (pT2N0) but with high risk (number of harvested lymph nodes is below 15, lymphovascular invasion, perineural invasion and histologic type is poorly differentiated adenocarcinomas, mucinous adenocarcinoma or signet ring cells carcinoma) and stage II and III. We use Xelox regimen according to CLASSISC trial (conducted in 2011 in Korea) as follows: intravenous 85mg/m² Oxaplatin for day 1 and oral Capecitabine 2000mg/m²/day for day 1-14. For cases with multiple lymph node metastases (pN2, pN3a, pN3b), 8 cycles of maintenance Capecitabine (dose of 2500mg/m²/day) or 10 months of maintenance Uracil-Tegafur (dose of 360mg/m²/day, 5 days per week), in cases of grade 3/4 hand-foot syndrome due to Capecitabine, were supplemented. The adjuvant radiotherapy has not been implemented for gastric cancer in Vietnam, currently.

Post-treatment follow-up were performed every 3 months for the first two years and then every 6 months from the 3rd year onward. Patients' routine follow-up schedule consisted of clinical examination, tumor marker (e.g. CEA level, CA 72.4), abdominal ultrasonography, chest X-ray every 3 months or thoraco-abdominal computed tomography (CT) every 6 months and gastric endoscopy once a year. If patients had

any suspicious symptoms, an additional examination was conducted. Disease free survival (DFS) was measured from the operation until the date of recurrence or the date that the last information about DFS was obtained. Overall survival (OS) was measured from the operation until the date of death or the date that the last information about OS was obtained

Statistical Analysis

Quantitative data were presented as mean \pm standard deviations (SDs) and categorical data were expressed as percentages. The survival rates were analyzed using the Kaplan-Meier method. All statistical analyses were performed with SPSS version 23.0

Ethics Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee. This research was accepted by Ethical Review Board of Hanoi Medical University (Approval No. IRB 0003121).

Result

From January 2015 to December 2017, sixty-two patients who were diagnosed as having gastric cancer were recruited into the study. The gender distribution presented 62.9% male and 37.1% female. The mean age of studied population was calculated as 57.15 ± 9.2 years old.

Mean BMI of the study sample was 20.4 ± 2.2 . Patients who had American Society of Anesthesiologists (ASA) physical status classification as 1 accounted for 80.6% of the study sample, following by those who had ASA class as 2 (19.4%). There was no patient had ASA classed beyond 2, and no patient had history of any type of abdominal surgery.

The lesion position was found mostly in antrum. Nowadays Vietnamese endoscopists have not possible extent described the location of the tumor in detail. For a gastric tumor in the antrum area, the endoscopists can only describe the finding of a gastric tumor located in antrum area, and cannot describe it in the middle or lower part of the antrum. So, it has not been answered as whether tumor has been located on the small curved edge, large curved edge, front or back of the stomach. The pathologist did not neither specify the location of the tumor on the macroscopic description. So, we could not record the longitudinal and circular location of the tumors.

100% gastric cancer patients were performed subtotal distal gastrectomy and D2 lymph node dissections. According to the 8th UICC staging of gastric cancer, one case was diagnosed with pT1 stage, 10 cases with pT2 stage and 51 cases with pT3 stage. There were 18 cases at stage of pN0, 20 cases at stage of pN1, 15 cases at stage of pN2, 6 cases at stage of pN3a and 3 cases at stage of pN3b. 100% patients show their disease were in M0 stage. The TNM stages were as follows: Ib, 6 (9.7%); IIa, 17 (27.4%); IIb, 16 (25.8%); IIIa, 14 (22.6%); IIIb, 6 (9.7%); and IIIC, 3 (4.8%) cases.

Regarding to histologic type, most of patients (46.8%) displayed moderately-differentiated adenocarcinoma, followed by signet ring cell carcinoma with 27.4%. Other histopathology such as poorly-differentiate carcinoma, mucinous adenocarcinoma and undifferentiated adenocarcinoma with signet ring cell amounted to 12.9%, 9.7% and 3.2%, respectively (**Table 1**).

The operative data was displayed in **Table 2**. The mean operation time was 259 ± 44 minutes and the average blood loss was calculated as 110.0 ± 23.0 ml. The number of harvested lymph node ranged from 10 to 45 (20 ± 4). The time to take first flatus after surgery was 3.6 ± 1.3 days, and postoperative period hospital stay was 11.8 ± 2.6 days.

There were two patients received blood transfusion after surgery. Of which, one patient presented intra-operative hemorrhage from left gastric artery injury during dissection; this patient was converted to open surgery and provided blood transfusion during and after the operation. The second patient was discovered anastomotic bleeding on the second day after surgery, then that patient was resuscitated, received blood transfusion and emergency endoscopic hemostatic intervention.

Conversion to open gastrectomy procedure during laparoscopic surgery occurred in 5 cases, of which 4 patients after placing the camera, we found large tumors which were invasive to surrounding organs so we decided to convert to open surgery. These patients had been excluded from the study because we wanted to focus on studying the results of laparoscopic surgery for stomach cancer rather than general gastric cancer surgery. One patient who had intra-operative hemorrhage from left gastric artery injury during dissection was converted to open surgery thusly. The time when the patient was given a soft diet was about 3.38 ± 0.9 days (ranging from 2-5 days) after the patient had bowel movements with no manifestation of nausea and vomiting. Readmission was observed in one case after one week of hospital discharge because of early signs of intestinal obstruction. This patient was received medical treatment by fasting, putting sonde on stomach, infusion, and using antibiotics, then the symptoms were relieved and the patient overcame intestinal obstruction complications after 24 hours of treatment.

The average tumor size was 2.1 cm (ranging from 1-3 cm). All patients in the study were performed gastrectomy 5 cm above the edge of the tumor (proximal margin) and 1 cm below the pylorus (distal margin). We did the frozen section procedure of the pathologic margin to all patients. Both the result of the described procedure and the result of the regular pathology were negative in 48 hours. Majority of patients (60 out of 62 patients) have number of dissected lymph nodes greater than or equal to 16; only 1 patient had a number of lymph nodes greater than 30.

Most of the patients were observed as having no surgical complication. Complications including anastomosis bleeding, pneumonia, early intestinal obstruction and intra-abdominal hemorrhage have the same number of patients (one patient for each complication).

All complications were at level II according to Clavien-Dindo classification. Exceptionally, patients with intra-abdominal hemorrhage during laparoscopic surgery were converted to open surgery.

All of patients were provided adjuvant chemotherapy after surgery (**Table 3**). Of these, Xelox was received in 38 patients with average number of cycles as 8, while Xelox plus 8 cycles of Capecitabine maintenance or 10 months of maintenance Uracil-Tegafur (dose of 360mg/m²/day, 5 days per week), in cases of grade 3/4 hand-foot syndrome due to Capecitabine, was applied in 24 patients (**Table 4**).

The follow-up period was prolonged for 3 years. Our study found the 3-year disease-free survival rate to be $83.8 \pm 4.7\%$ (**Figure 1**). The overall survival was estimated as 33.6 ± 20.6 months and the calculated 3-year overall survival rate was $83.8 \pm 4.7\%$ (**Figure 2**).

Discussion

In spite of the continuing reduction in incidence, gastric adenocarcinoma remains one of the most deadly malignant neoplasm in the world. Surgical resection and proper perigastric lymphadenectomy is the important treatment approach for increasing the survival rate in gastric cancer patients [9, 10]. Since the application of laparoscopic gastrectomy was first reported in 1990s, this minimally invasive gastrectomy has been performed with increasing frequency. Advocates of laparoscopic gastrectomy highlight the benefit in term of less tissue trauma, decreased postoperative pain, less blood loss, faster recovery, lower postoperative complication rate, and shortened hospital stay. Previous studies indicated that laparoscopic distal gastrectomy can be performed with low morbidity and mortality rate [11, 12]. Although laparoscopic distal gastrectomy was demonstrated its technical safety and feasibility in many publications, research on this surgical approach for gastric cancer treatment is still lacking in Vietnam. Hence, the goal of this study is to verify laparoscopic distal gastrectomy by assessing the surgical outcomes of gastric cancer patients.

Mean BMI of our study sample was calculated as 20.4 ± 2.2 . Patients who had ASA=1 accounted for 80.6% of the study sample, following by those who had ASA=II (19.4%). No patient had ASA classed beyond 2, and no patient had history of any type of abdominal surgery. Because laparoscopic surgery for gastric cancer treatment has recently been applied in Vietnam, we actively chose patients who were healthy, had less comorbidity and had no previous surgery history.

The operation time was defined as duration from the first skin incision to the closure of all skin incisions with skin staples. Previous studies demonstrated that LG is more time-consuming than OG [13-15]. For instance, Sang-Yong Son and Sang-Uk Han published their review article and indicated that laparoscopic distal gastrectomy (LDG) associated with 48.3 minutes longer operative time as compared to open gastrectomy (OG) [16]. In our study, 100% patients were performed subtotal distal gastrectomy and the mean operating time was calculated as 259 ± 44 minutes which seem to be comparable to previous studies. Specifically, Chi K.C et al performed laparoscopic surgery on 50 patients with gastric cancer and indicated that the operations prolong 244 ± 58.8 minutes averagely [13]. The operation time decreased gradually in later surgeries in our study as being consistent to the finding of Kunisaki C's study which showed that the operating time decreased to 230 minutes after 60 cases [17]. The reduction in operation time might be due

to the fact that we got substantial experience from performing laparoscopic gastrectomy. Although its initial application takes time and effort, safe and quick laparoscopic anastomosis can be eventually achieved if this technique would be well mastered.

Despite the prolonged operative time, laparoscopic approach presented a low amount of blood loss. The average blood loss in our surgeries was 110.0 ± 23.0 ml. In the KLASS-01 trial, Kim HH and colleagues found the blood loss to be 108.67 ± 133.01 ml in the LDG, which is significantly lower than that of OG, estimated as 200.41 ± 165.82 ml [18]. Similarly, Chen K et al found that blood loss on 124 gastric cancer patients undergoing laparoscopic surgery was 115.5 ± 70.2 ml, significantly lower than open approach with the figure of 210.5 ± 146.7 ml [14]. Also, Dulucq JL et al conducted study on comparison between laparoscopic and open surgery in gastric cancer treatment and suggested that blood loss was significantly lower in the laparoscopic gastrectomy group with the figure of 81 ± 107 ml [19]. The reduction of intraoperative blood loss is due to, firstly a clear visualization of operative field with the advantage of blood vessel identifying and exposing, and secondly, the use of special instruments, such as the harmonic scalpel and Ligasure.

This study found an average number of lymph nodes to be 20 ± 4 nodes. However, our finding was lower than previous studies which reported the number of retrieved lymph nodes exceed 30 [5, 13]. The difference might be because of that in the early period of our study, laparoscopic gastrectomy was not conducted perfectly, and technique of lymph node dissection was not well performed, which resulted in lesser number of harvested lymph node.

Earlier time to first flatus represents a faster recovery of bowel function, which affects directly earlier resumption of oral intake and reduction of hospital stay. In our study, the mean time to first flatus in our patients after surgery was 3.6 ± 1.3 days. This result was similar to a study of Dulucq et al which found the time to flatus was 3.6 ± 1.2 days in LG group, significantly lower comparing to OG group with figure of 4.7 ± 1.2 days [19]. In the KLASS-02 trial, Hyuk-Joon Lee et al suggested that in comparison with open approach group, first day of flatus was shortened in LDG (3.53 days vs. 3.71 days; $p=0.027$) and post-operative hospital stay was reduced in LDG (8.1 days vs. 9.3 days; $p=0.003$) [20]. Although the time to first flatus of our study was no different from other reports, the mean duration of postoperative hospitalization in our study was 11.8 ± 2.6 days, which was longer than that of Chen K's and Chi K.C study with average hospital stay as 8.9 ± 1.3 days and 9.6 ± 3.2 days, respectively [13, 14]. This difference is partly due to that the technique of laparoscopic gastrectomy has been carried out recently in our hospital, our surgeons are still reluctant to decide for patients to be discharged early. Additionally, few patients had complications after surgery, which make them stay in hospital longer, therefore the average number of days of hospitalization was increased.

The postoperative morbidity is an important outcome to evaluate the safety of the operation type. Complications after laparoscopic gastrectomy and lymphadenectomy were relatively low in both Korean and Japanese studies compared to open surgery. Clinical trial phase III (KLASS 01) in South Korea comparing

morbidity and mortality between LG and OG demonstrated that there was no significant difference between 2 groups. The rate of postoperative complications in 2 groups of LG and OG was 10.5% (17/179) and 14.7% (24/163), respectively ($P = 0.137$). Mortality rates were 1.1% (2/179) and 0% (0/163), respectively ($P = 0.497$) [18]. Kim et al conducted retrospective study on 1,237 patients undergoing assisted laparoscopic gastrectomy and showed that the rate of overall complications after surgery and anastomosis-related complications were 13.1% and 1.9%, respectively [21]. Besides, according to a large retrospective analysis of 1,185 laparoscopic gastrectomy cases, the incidence of postoperative complications was 12.7% in which anastomosis leakage accounted for 5.1% [22].

In our hospital, we recorded no case of death from surgery, duodenal stump leakage, pancreatic leakage, anastomosis leakage or lymphatic leakage and anastomosis stenosis. Similarly, the rates of anastomosis leakage, lymphatic leakage, anastomosis stenosis from other studies are also considerably low. Chen K et al reported that the rate of pancreatic leakage, anastomosis leakage, lymphorrhea and anastomosis stenosis are 1.6%, 2.4%, 0.8% and 1.6%, respectively [14]. The minimal invasiveness of laparoscopic approach could minimize the intervention to microenvironment of abdominal cavity and injury of intestinal serous membrane which was thought being able to reduce the development of postoperative ileus, pneumonia, intra-abdominal abscess, pancreatitis and adhesive bowel obstruction. Our study also showed that anastomosis bleeding, pneumonia, early intestinal obstruction and intra-abdominal bleeding account for the same percentage of 1.6%. These findings are consistent with Lin JX's study [23]. There was no case being detected as having pulmonary embolism. Besides, the rate of others pulmonary embolism is also very low which is similar to the study of Park D.J (0.8%) and Chen K (0.8%) [5, 14]. Also, in the KLASS-01 trial, Kim HH et al concluded that there was no significant difference in the morbidity and mortality between the 2 groups [18]

In spite of these favorable short-term results, the long-term outcome of laparoscopic gastrectomy for gastric cancer still needs to be proven in comparison with open gastrectomy. Concerns about the possibility of laparoscopy-related recurrence in laparoscopic gastrectomy may be associated with the likelihood of cancer dissemination during laparoscopy manipulation, leaving residual tumor at the resection margin, and performing an insufficient D2 lymphadenectomy. Our study found that the disease-free survival (DFS) and 3-year overall survival (OS) were 83.8% and 81.5%, respectively. Our results were comparable to previous reports [5, 24-26]. Gu J et al performed 113 laparoscopic gastrectomies for gastric cancer and suggested that 3-year disease free and overall survival rate were 64% and 62%, respectively [24]. A multivariate analysis by log-rank test found earlier pathological T status and earlier pathological N status to be significantly associated with prediction for longer disease-free survival and overall survival. The previous studies have indicated that survival outcome after LG for gastric cancer was not significantly different from that of standard open gastrectomy, nevertheless, most of those findings deviated slightly toward LG with favor. Furthermore, Han SU et al carried on study on 2,976 gastric cancer patients comparing laparoscopic

gastrectomy versus open gastrectomy by using propensity score matching and found no significant difference in overall survival, disease-specific survival and recurrence-free survival at each cancer stage [27].

Adjuvant chemotherapy was applied to cases with stage II, III or stage I (pT2N0) but with high risk factor (number of harvested lymph nodes is below 15, lymphovascular invasion, perineural invasion and histologic type is poorly differentiated adenocarcinomas, mucinous adenocarcinoma or signet ring cells carcinoma). At the moment, adjuvant treatment for gastric cancer is still different between European countries, the United States and Asian countries (South Korea, Japan). In Vietnam, basically, we use adjuvant chemotherapy with Xelox regimen according to CLASSIC trial (implemented in Korea in 2011), but for cases with multiple lymph node metastasis (pN2, pN3a, pN3b), 8 cycles of maintaining Capecitabine or 10 months of maintenance Uracil-Tegafur (dose of 360mg/m²/day, 5 days per week), in cases of grade 3/4 hand-foot syndrome due to Capecitabine were supplemented to reduce the risk of recurrence. In the meantime, adjuvant radiotherapy has not been implemented for gastric cancer treatment in Vietnam.

In conclusion, these data present that laparoscopic gastrectomy in Viet Nam is technically safe and feasible with less blood loss, sufficient lymph-node dissection, rapid recovery, and acceptable morbidity and the findings are consistent with previous studies in literature.

Conflict of interest

The authors declare that they have no conflicts of interest.

References

1. Yako-Suketomo H, Katanoda K. "Comparison of time trends in stomach cancer mortality (1990–2006) in the world, from the WHO mortality database", *Jpn J Clin Oncol*, 2009; 39: 622-23.
2. Parkin DM, Bray F, Ferla J, et al. "Global cancer statistics", *CA Cancer J Clin*, 2005; 55(2): 74-108.
3. Jeong O, Park YK. "Clinicopathological Features and Surgical Treatment of Gastric Cancer in South Korea: The Results of 2009 Nationwide Survey on Surgically Treated Gastric Cancer Patients", *J Gastric Cancer*, 2011; 11(2): 69-77.
4. Ferlay J, Shin HR, Bray F, et al. "Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008", *Int J Cancer*, 2010; 127: 2893-2917.
5. Park DJ, Han SU, Hyung WJ, et al. "Long-term outcomes after laparoscopy-assisted gastrectomy for advanced gastric cancer: a large-scale multicenter retrospective study", *Surg Endosc*, 2012; 26(6): 1548-53.
6. Dang Thi Nga, Ta Thanh Van, Dang Thi Ngoc Dung, et al. "Mutate EXON 2 gene in diffuse gastric cancer", *Journal of Medical Research*, 2018; 6: 32-37.
7. Sobin LH, Gospodarowicz MK, Wittekind C. "International Union Against Cancer (UICC) TNM classification of malignant tumours, 7th edition", Wiley-Liss, New York, 2010.

8. Japanese Gastric Cancer Association. "Japanese classification of gastric carcinoma: 3rd English edition", *Gastric Cancer*, 2011; 14(2): 101-112.
9. Ferlay J, Soerjomataram I, Dikshit R, et al. "Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012", *Int J Cancer*, 2015; 136: E359-86.
10. Kim JP. "Current status of surgical treatment of gastric cancer", *J Surg Oncol*, 2002; 79(2): 79-80.
11. Ghoneum M, Felo N, Nwaogu OM, et al. "Clinical trials in surgical oncology", *Asian Pac J Surg Oncol*, 2015; 1: 73-82.
12. Parisi A, Nguyen NT, Reim D, et al. "Current status of minimally invasive surgery for gastric cancer: A literature review to highlight studies limits", *Int J Surg*, 2015; 17: 34-40.
13. Kyong-Choun Chi, Joong Min Park. "Laparoscopic Gastrectomy Performed by an Expert in Open Gastrectomy", *J Gastric Cancer*, 2017; 17(3): 237-245.
14. Chen K, Pan Y, Zhai ST, et al. "Totally laparoscopic versus open total gastrectomy for gastric cancer: A case-matched study about short-term outcomes", *Medicine (Baltimore)*, 2017; 96(38): e8061.
15. Wang W, Zhang X, Shen C, et al. (2014), "Laparoscopic versus open total gastrectomy for gastric cancer: an updated meta-analysis", *PLoS One*, 2014; 9(2): e88753.
16. Sang-Yong Son, Sang-Uk Han. "Laparoscopic Distal Gastrectomy for Gastric Cancer", *J Minim Invasive Surg*, 2015; 18(1): 1-6.
17. Kunisaki C, Makino H, Yamamoto N, et al. "Learning curve for laparoscopic-assisted distal gastrectomy with regional lymph node dissection for early gastric cancer", *Surg Laparosc Endosc Percutan Tech*, 2008; 18(3): 236-41.
18. Kim HH, Hyung WJ, Cho GS, et al. "Morbidity and mortality of laparoscopic gastrectomy versus open gastrectomy for gastric cancer: an interim report-a phase III multicenter, prospective, randomized Trial (KLASS Trial)", *Ann Surg*, 2010; 251(3): 417-20.
19. Dulucq JL, Wintringer P, Stabilini C, et al. "Laparoscopic and open gastric resections for malignant lesions: a prospective comparative study", *Surg Endosc*, 2005; 19(7): 933-8.
20. Lee HJ, Hyung WJ, Yang HK, et al. "Short-term Outcomes of a Multicenter Randomized Controlled Trial Comparing Laparoscopic Distal Gastrectomy With D2 Lymphadenectomy to Open Distal Gastrectomy for Locally Advanced Gastric Cancer (KLASS-02-RCT)", *Ann Surg*, 2019.
21. Kim W, Song KY, Lee HJ, et al. "The impact of comorbidity on surgical outcomes in laparoscopy-assisted distal gastrectomy: a retrospective analysis of multicenter results", *Ann Surg*, 2008; 248: 793-9.
22. Kitano S, Shiraishi N, Uyama I, et al. "A multicenter study on oncologic outcome of laparoscopic gastrectomy for early cancer in Japan", *Ann Surg*, 2007; 245: 68-72.
23. Lin JX, Huang CM, Zheng CH, et al. "Evaluation of laparoscopic total gastrectomy for advanced gastric cancer: results of a comparison with laparoscopic distal gastrectomy", *Surg Endosc*, 2016; 30(5): 1988-98.

24. Gu J, Zhao E. "Laparoscopic gastrectomy for locally advanced gastric carcinoma: long-term survival outcomes and prognostic factor", *Int J Clin Exp Med*, 2016; 9(6): 11485-11493.
25. Chen XZ, Wen L, Rui YY, et al. "Long-term survival outcomes of laparoscopic versus open gastrectomy for gastric cancer: a systematic review and meta-analysis", *Medicine (Baltimore)*, 2015; 94: e454.
26. Lan H, Zhu N, Lan Y, et al. "Laparoscopic gastrectomy for gastric cancer in China: an overview", *Hepatogastroenterology*, 2015; 62: 234-239.
27. Kim HH, Han SU, Kim MC, 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.

Table 1. Characteristic of gastric cancer patient

Characteristics		Result
Age (mean \pm SD)		57.15 \pm 9.2
Gender	Male	39 (62.9%)
	Female	23 (37.1%)
BMI	20.4 \pm 2.2	
ASA	ASA 1	50 (80.6 %)
	ASA 2	12 (19.4%)
Previous abdominal surgery		0 (0%)
Position of lesion	Antrum	62 (100%)
pT	T1	1 (1.6%)
	T2	10 (16.1%)
	T3	51 (82.3%)
pN	N0	18 (29%)
	N1	20 (32.3%)
	N2	15 (24.2%)
	N3a	6 (9.7%)
	N3b	3 (4.8%)
Metastasis	M0	62 (100%)
	M1	0 (0%)
Histologic type	Moderately-differentiated adenocarcinoma	29 (46.8%)
	Poorly-differentiated adenocarcinoma	8 (12.9%)
	Mucinous adenocarcinoma	2 (3.2%)
	Signet ring cell carcinoma	17 (27.4%)
	Undifferentiated adenocarcinoma with signet ring cell	6 (9.7%)
Procedure	Total gastrectomy	0 (0%)
	Subtotal distal gastrectomy	62 (100%)
Extent of lymphadectomy	D2	62 (100%)
Pathologic stage	Stage Ib	6 (9.7%)
	Stage Iia	17 (27.4%)
	Stage Iib	16 (25.8%)
	Stage IIIa	14 (22.6%)
	Stage IIIb	6 (9.7%)
	Stage IIIc	3 (4.8%)

Table 2. Surgical results of gastric cancer patients

Surgical results		
Operation time (Mean \pm SD)		259.0 \pm 44.0 minutes
Number of dissected lymph nodes (Mean \pm SD)		20.0 \pm 4.0 (10-45)
Number of patients with dissected lymph node	≥ 16	60
	≥ 30	1
Tumor size (Mean \pm SD)		2.1 \pm 0.5 cm (1-3 cm)
Blood loss (Mean \pm SD)		110.0 \pm 23.0 ml
Time to take first flatus after surgery (Mean \pm SD)		3.6 \pm 1.3 days (1-5 days)
Postoperative hospital stay (Mean \pm SD)		11.8 \pm 2.6 days (6-22 days)
Reconstruction method	Intracorporeal gastrojejunostomy	0 (0%)
	Extracorporeal gastrojejunostomy	62 (100%)
Number of patients received blood transfusion		2 (3.2%)
Number of patients conversing to open surgery		5 (7.57%)
Time to start a soft diet (Mean \pm SD)		3.38 \pm 0.9 (2-5 days)
Number of cases with readmission after discharge		1 (1.6%)
Pathologic margin	Proximal	Negative
	Distal	Negative

Table 3. Postoperative complication

Surgical complication	Grade (Clavien-Dindo classification)	Number of patients	Percentage
No complications	N/A	58	92.2%
Anastomosis bleeding	II	1	1.6%
Pneumonia	II	1	1.6%
Early intestinal obstruction	II	1	1.6%
Abdominal bleeding	III	1	1.6%

Table 4. Adjuvant chemotherapy

Adjuvant chemotherapy	Number of patients	Average number of cycles	Average dose intensity
Xelox	38	8	95%
Xelox+Capecitabin/Tegafur-	24	8 cycles Xelox and 8 cycles	95%

Uracil maintenance	Capecitabin/10 months of Tegafur-Uracil
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Figure 1. Disease-free survival

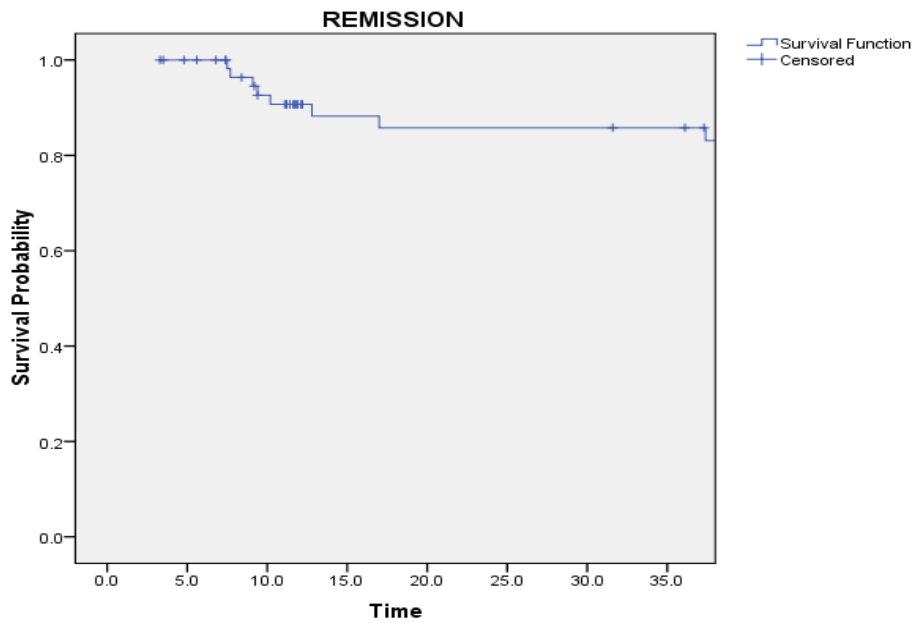


Figure 2. Overall survival

