

Post-operative outcomes of open and laparoscopic gastrectomy for gastric cancer: A single-center experience

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ABSTRACT

Introduction: Laparoscopy-assisted distal gastrectomy (LADG) has rapidly been gaining popularity. However, there is only limited evidence regarding its oncological safety. The aim of this study is to identify the effects of laparoscopy on post-operative complications and on the total number of excised and metastatic lymph nodes in cases with + D2 lymph node dissection due to gastric cancer.

Materials and Methods: 40 consecutive patients, who underwent gastrectomy and routine D2 lymph node dissection in our clinic between March 2019 and March 2020, were included in the study. The patients were divided into two groups as per the technique applied; open surgery (Group 1) and laparoscopic surgery (Group 2). Demographic characteristics, intra-operative time, need for blood transfusion, post-operative complications, and histopathological features were compared between the groups.

Results: The results of the study revealed that Group 1 had longer hospital stay periods ($p=0.03$) but other clinical features like intra-operative and post-operative complication rates were similar in both groups. Pathology results of the groups also showed no statistically significant difference in terms of the number of excised lymph nodes, the number of metastatic lymph nodes, and the ratio of metastatic lymph nodes to excised lymph nodes.

Conclusion: Laparoscopic surgery can be performed safely and may be recommended as a possible alternative to open surgery. The study emphasized a faster post-operative recovery as the main benefit of laparoscopic gastrectomy.

Keywords: Gastrectomy; gastric Cancer; laparoscopy.

Introduction

Gastric cancer has the fourth highest incidence among cancers worldwide and is the second most common cause of cancer-related mortality. It accounts for 8% of total cancer-related mortality globally while accounting for 10% of annual cancer-related mortality cases.^[1,2] Surgery remains

the single therapeutic method in spite of the developments in goal-directed therapy and chemoradiotherapy. Local or extended lymphadenectomy together with the total excision of macroscopic and microscopic malignant lesions represent the optimal treatment of choice for localized resectable gastric cancer.^[3]



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Laparoscopy-assisted distal gastrectomy (LADG) has been adopted rapidly worldwide since its inception in 1994.^[4] Many studies that compared laparoscopic and open surgery have confirmed that minimally invasive laparoscopic surgery had obvious advantages.^[5-7] Moreover there are also numerous other studies that have reported that there was no difference between laparoscopic and open surgery as per long-term outcomes for locally advanced gastric cancer.^[8-10]

This study investigated the intra-operative and post-operative clinical outcomes according to the surgical technique used in gastric cancer patients with distal gastrectomy and D2 lymph node dissection.

Materials and Methods

The Patients

The data of patients, who had undergone gastrectomy and routine D2 lymph node dissection at Diyarbakır University of Health Sciences, Gazi Yaşargil Training and Research Hospital's General Surgery Clinic between March 2019 and March 2020 because of gastric cancer, were retrospectively analyzed. All the patients were diagnosed with gastric adenocarcinoma confirmed by gastroscopic biopsy. All the patients received computerized tomography for pre-operative staging. Exclusion criteria included patients with palliative resection, conversion to open surgery from laparoscopy, and insufficient health file data.

60 patients had undergone surgery within this period having been diagnosed with gastric cancer. 40 of these patients who met the inclusion criteria were included in the study.

Grouping

The patients were categorized into two groups as per the technique used: those with open surgery (Group 1) and those with laparoscopic surgery (Group 2).

Data

Pre-operative data on the patients' ages, sexes, diabetes mellitus (DM), hypertension (HT), chronic obstructive pulmonary disease (COPD), chronic renal failure, pre-operative laboratory results, and history of smoking were retrospectively collected. Intra-operative time (minutes), blood transfusions during the surgery, and period of hospitalization (days) were recorded as well.

Mortality during the first 30 days of follow-up during the post-operative period was defined as surgical mortality,

while surgical complications that developed during the same period were defined as morbidity. Post-operative complications were ranked according to the Clavien-Dindo Classification.^[11]

Tumor size (mm), distal border (mm), proximal border (mm), invasion depth, number of lymph nodes excised, number of metastatic lymph nodes detected, and the lymphovascular and perineural invasion presence of the tumor were recorded based on pathology reports. The ratio of metastatic lymph nodes to the excised lymph nodes (LNR) was categorized into four groups as LNR: 0, $0 < \text{LNR} \leq 0.1$, $0.1 < \text{LNR} \leq 0.4$, $\text{LNR} > 0.4$. The pathological staging of the tumor was performed according to the 7th edition of the American Joint Committee on Cancer's (AJCC) TNM staging system.^[12]

I. The primary endpoint of the study was to investigate whether laparoscopic surgery posed technical challenges and caused post-operative complications.

II. The secondary endpoint of the study was to reveal the degree to which laparoscopic surgery affected pathology results.

Statistical Analysis

SPSS (Statistical Package for Social Sciences, Inc., Chicago, IL, USA) for Windows 21.0 software was used to perform statistical analyses of the data collected within the scope of the study. The mean, minimum, maximum, and standard deviation values were calculated for the data collected from the patients included in the study. Further the Kolmogorov-Smirnov test was used to control the distribution of data while group Student's t-test was used to analyze data with normal distribution. Group comparisons of non-parametric data were performed by the Mann-Whitney U test. Categorical groups were compared by the chi-squared test. $P < 0.05$ was set as statistically significant.

Results

Demographic Characteristics

4 patients with palliative gastrectomy, 4 patients with conversion from laparoscopy to open surgery, 10 patients with insufficient health file data, and 2 patients who did not receive D2 lymph node dissection between March 2019 and March 2020 were excluded from the study. Finally the data of 40 patients who underwent gastrectomy and D2 lymph

node dissection because of gastric cancer were analyzed within the scope of the study. While Group 1 covering open surgery patients had 22 patients, Group 2 covering laparoscopic surgery patients had 18 patients. The clinical characteristics of the patients are summarized in Table 1.

Intraoperative Features and Post-operative Complications

The results of the study revealed no difference between the groups in terms of intra-operative time and need for blood transfusion. No mortality was observed within the first 30 post-operative days in either of the groups. The period of hospitalization was found to be higher in Group 1 ($p=0.03$). Table 2 presents intra-operative features, surgical and non-surgical post-operative complications. Table 3 summarizes the comparison of complications according to the Clavian-Dindo Classification.

Pathology Results

No difference was found between the groups in terms of tumor size, the number of total and metastatic lymph nodes excised. Table 4 presents the pathological characteristics of the tumors (Table 4).

Discussion

Gastric cancer (GC) remains one of the most common and deadly malignities worldwide.^[2, 11, 12] Adequate lymphadenectomy and surgical resection continue to be the cornerstone and foundation of curative treatment for resectable GC patients.^[13, 14] Open gastrectomy (OG) has long been the surgical modality of choice worldwide. Yet it has been associated with significant morbidity. Laparoscopic surgeons have been sparing no efforts to alter clinical practice that would minimize surgical trauma. Laparoscopic gastrectomy (LG) has such potential benefits as reducing post-operative complications and accelerating healing.^[15]

Table 1. Demographic features of the patients according to the groups

	Group 1 (n=22)	Group 2 (n=18)	p
Age (mean±SD)	60.7±11.3	64.2±11.3	0.934
Sex, n (%)			
Male	17 (77.3)	10 (55.6)	0.145
Female	5 (22.7)	8 (44.4)	
Laboratory results (mean±SD)			
Hematocrit	36.3±6.4	35.03±4.8	0.424
Albumin	3.8±0.6	3.7±0.4	0.078
CEA	2.2±2.7	4.2±4.6	0.051
CA 19-9	124±435	24±49	0.126
CA 125	45.5±91	36±65	0.845
Comorbidity, n (%)			
DM	5 (22.7)	4 (22.2)	0.970
COPD	6 (27.3)	3 (16.7)	0.424
CRF	0	1 (5.6)	0.263
CAD	4 (18.2)	2 (11.1)	0.533
HT	5 (22.7)	7 (38.9)	0.267
History of smoking, n (%)	10 (45.5)	3 (16.7)	0.053
Weight loss (>10%), n (%)	7 (31.8)	6 (33.3)	0.919
ASA, n (%)			
1	0	0	0.131
2	7 (31.8)	10 (55.6)	
3	15 (68.2)	8 (44.4)	

CEA: Carcinoembryonic antigen; CA 19-9: Carbohydrate antigen 19-9; CA 125: Carbohydrate antigen 125; DM: Diabetes mellitus; COPD: Chronic obstructive pulmonary disease; CRF: Chronic renal failure; CAD: Coronary artery disease; HT: Hypertension; ASA: American Society of Anesthesiologists.

Table 2. Intra-operative features and post-operative complications

	Group 1	Group 2	p
Intra-operative time (mean±SD)	140±75	181±130	0.498
Intra-operative blood transfusion, n (%)	5 (22.7)	4 (22.2)	0.970
Abdominal complication, n (%)			
Surgical site infection	5 (22.7)	3 (16.7)	0.634
Abdominal abscess	0	0	
Anastomotic fistula	0	0	
Intraabdominal hemorrhage	3 (13.6)	1 (5.6)	0.397
Chylous ascites	1 (4.5)	1 (5.6)	0.884
Evisceration or eventration	1 (4.5)	0	0.360
Pancreatic fistula	0	1 (5.6)	0.263
Systemic complication, n (%)			
Atelectasis	1 (4.5)	3 (16.7)	0.204
Pneumonia	3 (13.3)	4 (22.2)	0.477
Renal failure	2 (9.1)	1 (5.6)	0.673
ARDS	0	0	
Catheter infection	2 (9.1)	0	0.189
Period of Hospitalization (mean±SD)	6.3±1.5	5.05±0.87	0.03^x
In-hospital Mortality, n (%)	0	0	

^xThe results of Student's t-test revealed a statistically significant difference between the groups (p<0.05).

Table 3. The comparison of complications according to the clavian-dindo classification

	Group 1 n (%)	Group 2 n (%)	p
No complications	11 (50)	9 (50)	0.670
Clavian-dindo classification			
I	2 (9.1)	0	
II	5 (22.7)	5 (27.8)	
III	2 (9.1)	3 (16.7)	
IV	2 (9.1)	1 (5.6)	
V	0	0	

Minimally invasive therapy has become a fundamental management strategy for early GC.^[16] Randomized and prospective evidence, which supported the fact that LG's safety and oncological outcomes were not poor, has constantly and actively been produced by laparoscopic researchers in Asia where LG has gained rapid popularity.^[17-19]

Laparoscopic resection was initially recommended especially for the treatment of early GC with distal localization in the stomach.^[16] A randomized controlled study by

Korean researchers (2010),^[20] compared laparoscopic distal gastrectomy (LDG) with open distal gastrectomy (ODG) for the treatment of cTNM stage I gastric adenocarcinoma in 342 patients. The results of the study found no significant difference between the groups in terms of post-operative complication (11% vs. 15%) or mortality rates (1% vs. 0%). Moreover, two other studies conducted in Korea^[21, 22] ascertained similar and even significantly lower rates of overall and wound site complications. Laparoscopic surgery has become an acceptable method for locally advanced GC following further studies as well.^[23, 24]

Operative time, need for blood transfusion and the number of excised lymph nodes were identified as surgical challenges within the scope of our study. No difference, however, was found between the groups. Intra-abdominal and systemic complications were designated as post-operative complications but no difference was found between the groups.

Surgeons in Japan have been routinely been performing extended lymphadenectomy (D2).^[7] The National Comprehensive Cancer Network (NCCN) recommended in its latest panel that perigastric and celiac axis localized lymph nodes (D2) should be excised on the condition that at least

Table 4. Pathologic features

	Group 1		Group 2		p
	Mean	SD	Mean	SD	
Maximum tumor size (mm)	55	28	60.1	30.7	0.575
Proximal Border (mm)	35.8	30.2	32.6	31.2	0.727
Distal Border (mm)	67.7	36.6	50.6	33.8	0.256
Number of Excised Lymph Nodes	23	9.7	28.5	10.6	0.789
Number of Pathological Lymph Nodes	4.9	6.4	5.3	11.3	0.469
	n	%	n	%	
LNR					
LNR: 0	7	31.8	8	44.4	0.793
0 < LNR ≤ 0.1	3	13.6	3	16.7	
0.1 < LNR ≤ 0.4	8	36.4	5	27.8	
LNR > 0.4	4	18.2	2	11.1	
Depth of Infiltration					
T1	1	4.5		0	0.669
T2	1	4.5	1	5.6	
T3	9	40.9	10	55.6	
T4	11	50	7	38.9	
Lymph Node Involvement					
N0	7	31.8	8	44.4	0.714
N1	4	18.2	4	22.2	
N2	5	22.7	2	11.1	
N3	6	27.3	4	22.2	
Vascular invasion	14	63.6	7	38.9	0.119
Perineural invasion	18	81.8	14	77.8	0.751

LNR: Lymph Node Ratio, the ratio of metastatic lymph nodes to excised lymph nodes.

15 lymph nodes be harvested.^[25–27] The German Gastric Cancer Study put forth that if the number of excised lymph nodes was more than 25 it would be called D2 dissection, while the procedure would be referred to as D1 dissection if the number was between 15 to 25, and as radical surgery if less than 15 lymph nodes were dissected.^[28] A prospective Italian study^[29] also assessed LG versus OG for locally advanced GC. The authors of the study did not find any significant difference between the LG and OG groups in terms of 5-year cancer-related mortality rates (50% vs. 52%) and 5-year overall mortality rates (55% vs. 56%). Accordingly the authors could have compared cancer-related and overall survival rates. The Chinese database,^[15] on the other hand, found that the LG group had a significantly higher number of dissected lymph nodes at stations 11 and 12. The researchers, however, did not find any statistically significant difference between the two groups in terms of

the therapeutic index at each LN station.

The results of our study revealed that 15 and higher number of lymph nodes were excised from 38 out of 40 patients (95%). When the mean number of excised lymph nodes was assessed, it was found that this figure was 23 in OG while it was 28.5 in LG but there was no statistically significant difference between the two groups. Moreover, no statistically significant difference was found between the two groups in terms of the number of metastatic lymph nodes and the ratio of metastatic lymph nodes to the number of excised lymph nodes.

Our study had a couple of important limitations. Our study was a retrospective observational one conducted with a limited number of patients that, in turn, led to certain limitations in its design.

We suggest that laparoscopy does not affect the total num-

ber of excised and metastatic lymph nodes in gastric cancer surgery. Moreover it does not lead to an increase complication rates. We, therefore, believe that centers with laparoscopic experience should neither be concerned about not being able to excise adequate number of lymph nodes nor about high complication rates in laparoscopic gastric cancer procedures. Nevertheless prospective studies with a wide population are needed for clearer results.

Disclosures

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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