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Previous open gastric surgery is not a contraindication for laparoscopic gastric cancer surgery

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Abstract

A history of previous open abdominal surgery adversely affects the number of retrieved lymph nodes and increases the length of hospital stay after subsequent laparoscopic surgery. The aim of this study was to investigate the clinical significance of the previous open gastric surgery (POGS) for laparoscopic gastric cancer surgery (LGCS). We retrospectively examined the medical records of 150 gastric cancer patients who had adenocarcinoma and were operated laparoscopically. Patients were divided into two groups according to the history of POGS as POGS group (n=5) and none-POGS group (n=145). The laboratory parameters, clinical and operative data were assessed between the groups. The preoperative data were similar in both groups, except for tumor location. The length of hospital stay was longer, the number of excised and positive lymph nodes were lower in the POGS group ($p=0.023$, $p=0.016$, and $p=0.045$, respectively). The operation time was longer in the POGS group, although this difference was not significant [300 min (120-720 min) to 390 min (360-430 min), $p=0.057$]. POGS in patients with POGS can be performed safely with similar perioperative outcomes compared to the patients with none-POGS. POGS may prolong the hospital stay. In addition, the number of excised lymph nodes may be lower. Nevertheless, POGS should not be regarded as a contraindication for LGCS.

Keywords: Minimally invasive, hospital stay, gastric adenocarcinoma, history of abdominal surgery

Introduction

Remnant gastric cancer is the cancer of the stump or the remnant stomach developing after gastrectomy for either benign or malignant disease [1]. Open gastrectomy is preferred in remnant gastric cancer surgery because of severe adhesions and difficulty in anatomical orientation after the first gastric surgery. However, as the use of laparoscopy in gastric cancer surgery has increased, laparoscopy has become an option for remnant gastric cancer surgery [2].

Most of the surgeons agree on the technical difficulties of reoperation on a patient with previous abdominal surgery. Intra-abdominal adhesions are an inevitable consequence of abdominal

surgery, and these prevent a safe entry into the abdomen [3]. It is thought that having a history of the previous laparotomy because of gastric cancer surgery and the other intraabdominal surgeries may increase the complication rate, the length of hospital stay (LOHS) [4], and the operative time [5] in the patients scheduled for laparoscopy. However, the information about the oncological results of the laparoscopic approach in this condition is limited [5].

In the presented study, we aimed to evaluate both the technical and the oncological outcomes of laparoscopic gastric cancer surgery (LGCS) in patients with a history of previous open gastric surgery (POGS).

Materials and Methods

This study was approved by the local ethical committee (2020/1146). One hundred and eighty-five patients underwent LGCS between November 2014 and December 2020. The inclusion criteria were the age >18 years, the diagnosis of gastric adenocarcinoma, and curative surgery. Thirty-five patients were

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excluded due to palliative surgery and diagnoses other than adenocarcinoma. Finally, one hundred and fifty patients were included in the study. The patients were divided into two groups according to the history of POGS as POGS group (n=5) and none-POGS group (n=145). Four patients in the POGS group had undergone gastric surgery for peptic ulcer (three patients with subtotal gastrectomy, one patient with gastroenterostomy), and one patient had had proximal gastrectomy for gastric adenocarcinoma. Written informed consent was obtained from patients before surgery. The operations were performed by the senior surgeon or training surgeons under the supervision of the senior surgeon. The details of the surgical procedures have been reported in a previous study [1]. Postoperative complications were defined as any complication that occurred during the hospital stay or in the first 30 days after surgery and were classified according to the Clavien-Dindo classification [6]. Any complication grade 3 or higher was accepted as a severe complication.

Age, gender, The American Society of Anesthesiologists classification (ASA), body mass index (BMI), carcinoembryonic antigen (CEA) (normal value between 0-5.5 ng/ml) and carbohydrate antigen 19.9 (CA 19-9) (normal value between 0-35 IU/ml) levels, tumor location, operative time, intraoperative blood loss, laparotomy conversion rate (LCR), time to oral intake, LOHS, reoperation rate, pathological tumor stage and tumor size, number of retrieved and positive lymph nodes, postoperative

complications, 30-day, and 90-day mortality were analyzed.

Statistical analysis

The normality of the distribution of numerical variables was analyzed with the Shapiro-Wilk test. Numerical variables were described as median (minimum-maximum) and were compared with the Mann-Whitney U-test. Categorical variables were described as frequency (percentage) and were analyzed by using the chi-square tests or the Fisher's exact test, as appropriate. IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, NY, USA) was used for statistical analyses, and two-sided p-value <0.05 was considered significant.

Results

Table 1 shows the preoperative findings and demographics of the patients. No significant difference was found between the groups except for tumor location.

Intraoperative and postoperative variables are summarized in Table 2. The POGS group had a significantly longer LOHS (p=0.023). The tumor size, the number of retrieved lymph nodes, and positive lymph nodes were significantly lower in the POGS group (p=0.018, p=0.016, and p=0.045, respectively). The operation time was nearly significantly longer in POGS group (p=0.057).

Table 1. Preoperative findings and demographic data of the patients.

Total (n=150)		Previous open gastric surgery		P value
		None-POGS group (n=145)	POGS group (n=5)	
Age (years)	63 (19-91)	63 (19-91)	65 (49-74)	0.702
Gender (male)	105 (70%)	102 (70.3%)	3(60%)	0.636
BMI (kg/m ²)	25 (15.8-45)	25 (15.8-45)	20.57 (17.8-30.4)	0.362
ASA				
1	19 (12.7%)	19 (13.1%)	-	0.682
2	102 (68%)	98 (67.6%)	4(80%)	
3	29 (19.3%)	28 (19.3%)	1 (20%)	
CEA (ng/ml)	1.88 (0-167)	1.90 (0-167)	1.10 (0.07-3.07)	0.215
CA 19-9 (IU/ml)	9.10 (0-707)	9.20 (0-707)	7.40 (0.26-52)	0.620
Tumor location				
Upper third	52 (34.7%)	52 (35.9%)	1 (20%)	<0.001
Middle third	12(8%)	12 (8.3%)	-	
Lower third	76 (50.7%)	76 (52.4%)	-	
Whole stomach	5 (3.3%)	5 (3.4%)	-	
Remnant	5 (3.3%)	0 (0%)	4 (80%)	

BMI: Body mass index

ASA: The American Society of Anesthesiologists classification

CEA: Carcinoembryonic antigen

CA 19-9: Carbohydrate antigen 19.9

Table 2. Intraoperative and postoperative variables.

Total (n=150)		Previous open gastric surgery		P value
		None-POGS group (n=145)	POGS group (n=5)	
Operative time (min)	306 (120-720)	300 (120-720)	390 (360-430)	0.057
Intraoperative blood loss (ml)	100 (0-900)	100 (0-900)	100 (20-400)	0.775
Conversion (yes)	14 (9.3%)	13 (9%)	1 (20%)	0.392
Time to oral intake (day)	2 (1-11)	2 (1-11)	2 (1-10)	0.537
Length of hospital stay (day)	7 (3-48)	7 (3-48)	9 (8-34)	0.023
Reoperation (yes)	13 (8.7%)	12 (8.3%)	1 (20%)	0.369
Postoperative serious complication (yes)*	19 (12.7%)	18 (12.4%)	1 (20%)	0.497
Tumor size (cm)	5.80 (0-25)	6 (0-25)	3 (0.60-5)	0.018
Retrieved lymph nodes	30 (1-84)	31.5 (2-84)	15 (1-28)	0.016
Positive lymph nodes	4 (0-59)	4 (0-59)	0 (0-11)	0.045
Pathological T stage				
Insitu	4 (2.7%)	4 (2.8%)	-	0.969
T1	23 (15.3%)	22 (15.2%)	1(20%)	
T2	7 (4.7%)	7 (4.8%)	-	
T3	50 (33.3%)	48 (33.1%)	2(40%)	
T4	66 (44%)	64 (44.1%)	2(40%)	0.187
30-day mortality (yes)	6 (4%)	5 (3.4%)	1(20%)	
90-day mortality (yes)	10 (6.7%)	9 (6.2%)	1 (20%)	

*Clavien dindo≥3

The other parameters did not significantly differ between the groups.

Conversion to laparotomy was occurred in a patient due to pancreatic invasion of a remnant gastric cancer in POGS group. The reasons for the conversion to laparotomy in the none-POGS group were the difficulty to get the tumor-free proximal margin laparoscopically in three patients, locally advanced gastric cancer for four patients, mesenteric injury due to trocar access, massive subcutaneous emphysema, the difficulty of performing the esophagojejunostomy due to adhesions, esophagojejunostomy leakage detected intraoperatively, suspicion of hepatoduodenal ligament invasion, and deep bradycardia.

Postoperative serious complications occurred in nineteen patients (one in the POGS group and eighteen in the none POGS group.) The patients with leakages (One with duodenal stump leakage, one with

jejunogastronomy leakage, one with both esophagojejunostomy and enteroenterostomy leakage, one with esophagojejunostomy leakage only, one with enteroenterostomy leakage only, one with gastroenterostomy leakage and evisceration) were managed surgically. One patient with duodenal stump leakage and one with esophagojejunostomy leakage were treated conservatively. One patient with enteroenterostomy stricture was treated surgically. Vascular complications occurred in six patients (one with hemorrhage in gastroenterostomy stapler line, one with splenic artery bleeding, one with hepatic artery thrombosis, and two patients with intraabdominal hemorrhage, and one patient with postoperative celiac artery thrombosis), and they were reoperated. A patient developed fascial dehiscence on postoperative day 9 and was treated surgically. Three patients were treated with interventional procedures (intraabdominal abscess was drained percutaneously in one patient, biloma was drained percutaneously

in one patient, and hydronephrosis was treated with double j catheter in one patient.)

Mortality was observed in six patients during their hospital stay. Two patients with esophagojejunostomy leakage died due to sepsis. One patient with enteroenterostomy leakage died due to pulmonary aspiration. Another patient underwent repeated laparotomies due to intraabdominal hemorrhage. The bleeding focus could not be detected, and multiple organ resections were performed due to intestinal ischemia. All efforts failed, and the patient died. Postoperative celiac artery thrombosis due to the thermal injury during energy-based device use occurred in a patient. Repeated laparotomies and multiple organ resections were performed to solve the complication, but all efforts failed, and the patient died. One patient in the POGS group died after enteroenterostomy stricture revision surgery due to pneumonia.

Discussion

In this study, we found that the history of POGS prolonged only the hospital stay as a negative situation after LGCS. The operative time was longer in the POGS group, but the difference was not significant. Furthermore, the number of excised lymph nodes was lower in the POGS group, as expected. Based on these results, we argue that the history of POGS should not be regarded as a contraindication for LGCS.

Parallel to our study, some previous studies reported that the history of previous abdominal surgery (PAS) does not affect the early results of laparoscopic gastrectomy [7]. However, trocar entry and adhesiolysis are essential issues in laparoscopic surgery in patients with a history of PAS, as organs adhering to the abdominal wall may be damaged during these processes [8]. Entering the first trocar away from the previous incision or using the open entry technique may prevent complications from the trocar entry [5,8,9]. After the trocar entry, adhesiolysis is the first step of the laparoscopic approach for patients with PAS history, and patients with remnant gastric carcinoma are good examples of this situation [5]. In these patients, the adhesions mainly occur around the anastomotic site and the stapler lines [8]. As expected, adhesiolysis increases the operative time [5], which is probably the reason for a longer operative time in the POGS group in our study.

Tsunoda [8] and Nunobe [10] reported that the history of PAS did not affect the LOHS. On the contrary, Yamamoto et al. [11] evaluated the effect of PAS on laparoscopic colorectal surgery and stated that the patients who had a history of PAS had a longer hospital stay. This study revealed a longer hospital stay in the POGS group. We think the reason for this is that, although the differences were not statistically significant, the POGS group had a higher LCR, reoperation, and serious postoperative complication rates. As a matter of course, these higher rates might be the cause of prolonged stay at the hospital.

Tsunoda et al. [8] stated that in patients with previous upper abdominal surgery, laparoscopic gastrectomy was not inferior to the open approach for adequate lymph node dissection. Nunobe et al. [10] denoted that a dry operation area would be sufficient for adequate lymphadenectomy in patients with PAS. Opposite to these, in a retrospective study including 1313 patients, it was concluded that the history of PAS was an independent risk factor

for inadequate lymph node dissection [12]. In a study comparing open and laparoscopic gastrectomy for remnant gastric cancer, the number of positive lymph nodes was higher in the open gastrectomy group, but no difference was found in the number of retrieved lymph nodes. The authors stated that oncologic outcomes are equal for both approaches [13]. In this study, we found that both the number of retrieved and positive lymph nodes were lower in the POGS group. We attributed this situation to the three patients who had subtotal gastrectomy and one patient who had proximal gastrectomy in the POGS group. These previous gastrectomies probably included at least partial omentectomy and perigastric tissue resection, and this may be the reason for the decrease in the number of lymph nodes.

Kim et al. [4] found a higher LCR in patients with a history of major abdominal surgery such as gastrectomy or colectomy. Although the LCR was higher in the POGS group, the difference was statistically insignificant in the present study. The rate of serious postoperative complications after laparoscopic gastrectomy for gastric cancer is between 10.0-15.6% in patients with PAS [7]. However, we found this rate slightly higher than in the literature in the POGS group, 20% to be precise.

We acknowledge that this study had several limitations. The present study was a single-center, non-randomized, retrospective study. The study groups, especially the POGS group, had a small number of patients. In addition, we could not compare the outcomes of laparoscopic and open gastrectomy. Finally, the study did not include the long-term results.

Conclusion

LGCS in patients with POGS can be performed safely with similar perioperative outcomes compared to the patients with no POGS. LGCS may prolong the hospital stay. In addition, the number of retrieved lymph nodes may be lower. Nevertheless, further studies are needed for the oncological outcomes of this situation.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

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Ethical approval

This study was approved by the local ethical committee (2020/1146).

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