Original Article

Open distal gastrectomy versus laparoscopic distal gastrectomy for early gastric cancer: a retrospective study

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Background: Laparoscopic distal gastrectomy (LDG) is gaining popularity because its early postoperative effect has been shown to be better than open distal gastrectomy (ODG). However, to our knowledge, there are no studies demonstrating ODG is oncologically equivalent to LDG.

Methods: This is a retrospective study based on the prospectively maintained database of the People's Hospital of Jinan City. Patients with operable, pathologically confirmed early-stage gastric cancer were included, while those with advanced disease or carcinoma *in situ* were excluded. Extracted data included age, body mass index (BMI), sex, clinical TNM stage, and pathologic stage. The primary outcome was 5-year overall survival, and the secondary outcomes included cancer-specific survival, cost-effectiveness, and quality of life.

Results: A total of 126 patients were finally enrolled and included 61 in the ODG group and 65 in the LDG group. Baseline clinical and pathological characteristics were generally balanced between the two groups. After a median follow-up of 8.31 years, the 5-year overall survival rate was estimated to be 82.8% (95% CI: 69.4–90.7%) for the ODG group and 86.7% (95% CI: 73.9–93.5%) for the LDG group and the recurrence patterns were similar between the two groups.

Conclusions: Our data showed that the surgical results of both approaches are satisfactory, and LDG offers a reasonable option to ODG in patients with early gastric cancer.

Keywords: Laparoscopic distal gastrectomy (LDG); open distal gastrectomy (ODG); retrospective; survival analysis

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Introduction

Laparoscopic gastrectomy is widely used to treat gastric cancer, especially when in its early stages (1-3). While in comparison with laparotomy, laparoscopic gastrectomy has shown better short-term curative effects (4-6), relevant well-designed randomized clinical trials are lacking, and its oncological safety remains controversial.

Although the early results of most randomized clinical trials on early gastric cancer have demonstrated the short-term benefits and safety of laparoscopic procedures (7-10), data associated with the long-term safety and effects of this approach have been limited. Therefore, to fill this research gap and provide more information for clinicians to make decisions, we searched the prospectively maintained database

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of the People's Hospital of Jinan City and performed the present retrospective study to compare the long-term safety of open distal gastrectomy (ODG) versus laparoscopic distal gastrectomy (LDG) (11). Different from a previous report that compared ODG and LDG for early gastric cancer based on Japanese Database (12), the present study mainly focused on Chinese patients. We reported the study following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines (13) and completed the STROBE reporting checklist (available at https://dx.doi.org/10.21037/jgo-21-782) .

Methods

Patient enrollment and data collection

This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) (14). Ethical approval and individual consent for this retrospective analysis were waived by the Ethics Committee of our hospital.

Data on all patients diagnosed with gastric cancer suitable for distal gastrectomy from May 2011 to May 2020 and appearing in the database of the People's Hospital of Jinan City was obtained. Patients with operable, pathologically confirmed early-stage gastric cancer were included, while those with advanced disease or carcinoma in situ were excluded.

Extracted data included age, sex, clinical TNM stage, body mass index (BMI), number of retrieved lymph nodes, extent of lymphadenectomy, tumor size, and pathologic stage. Patients were aged between 20 and 80 years, with early gastric cancer (T1N0M0, T1N1MO, or T2aN0M0) without surgery. The exclusion criteria were as follows: those with other malignant tumors, an American Society of Anesthesiologists score greater than 3, previous chemotherapy or radiotherapy, and other benign diseases other than cholecystectomy.

Objectives and outcomes

Our primary objective was to investigate whether LDG is inferior to ODG in terms of long-term survival for early-stage gastric cancer. The primary outcome was 5-year overall survival, which was defined as the number of years from the date of surgery to the date of death from any cause. The secondary outcomes included cancer-specific survival, which was defined as time from gastrectomy to death, incidence rate and mortality, cost-effectiveness, and quality of life.

Operations and follow-up

A standard radical distal gastrectomy D1+β or D2 lymphadenectomy was performed for both approaches according to the Japanese classification (15). Lymph node station 14v dissection was optional, while all patients underwent partial omental resection. The reconstruction method used depended on the preference of each surgeon. During LDG, *in vitro* reconstruction was performed through a small incision of less than 5 cm in the upper abdomen.

We followed each patient regularly and follow-up data, such as recurrence and death, were recorded, and the same follow-up protocol was used in both groups. Patients were followed up every 3 months in the first 2 years, every 6 months in the next 3 years, and then once each year.

Statistical analysis

Data analysis was performed using R statistics, version 3.1.1 (R Foundation for Statistical Computing). Mann-Whitney tests or *t*-tests were used for continuous variables and χ^2 or Fisher exact tests were used for categorical variables. The overall survival and cancer-specific survival rate were estimated by performing Kaplan-Meier curves. After the proportional risk hypothesis was confirmed, the hazard ratios (HRs) and unilateral compliance of 97.5% were estimated by a Cox proportional risk regression model. Unless otherwise noted, 97.5% of unilateral confidence intervals (CIs) were reported as survival differences and HRs, and other CIs were bilateral 95% CI. P values less than 0.05 was considered statistically significant. All the above analyses were performed using SPSS (IBM SPSS Statistics 26.lnk).

Results

Patients

A total of 189 patients [mean (SD) age, 61.4 (10.3) years; 126 (66.7%) male and 63 (33.3%) female] with clinical stage I gastric adenocarcinoma were screened out from the database of the People's Hospital of Jinan City. Among them, 100 patients underwent LDG and 89 underwent ODG. After searching the database, 57 patients were

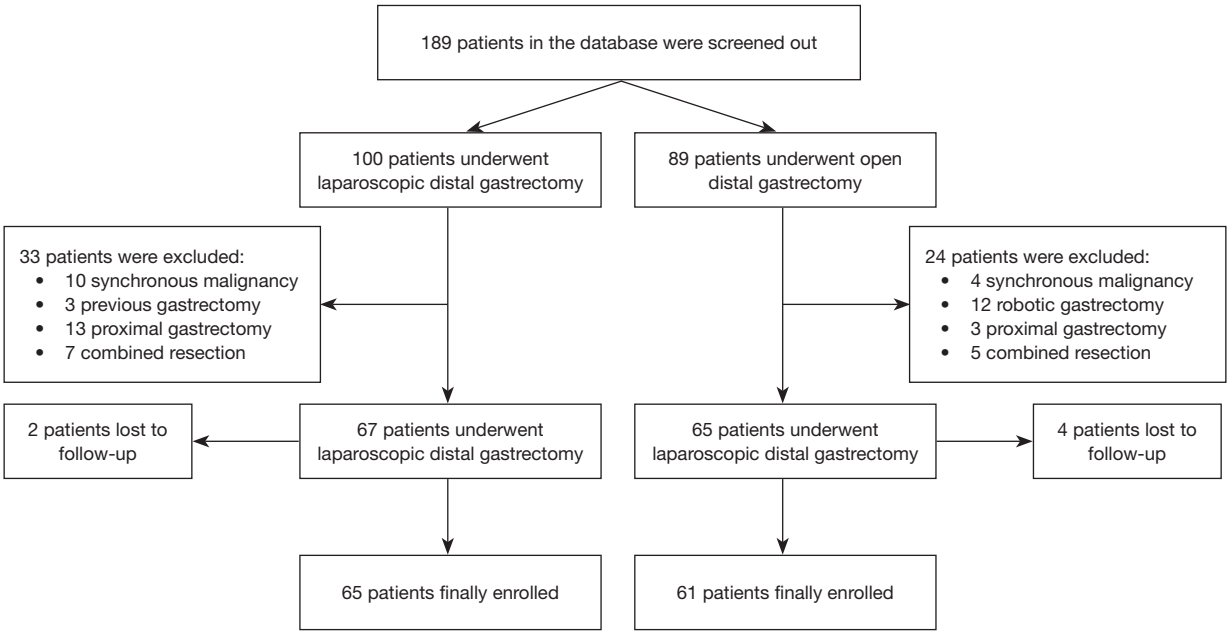

Figure 1 Selection process.

excluded for various reasons, leaving 126 patients of which 65 underwent LDG and 61 underwent ODG. A detailed flow diagram of the selection process is shown as *Figure 1*. The baseline clinical characteristics, pathologic features and staging were balanced between the two groups, as shown in *Table 1*.

Surgical and pathological outcomes

Except for one case of peritoneal cancer in the LDG group, all other patients underwent radical gastrectomy and systematic lymph node dissection (D1+ or D2). The average number of resected lymph nodes was less than 16 lymph nodes in each group (P<0.05). No tumor margin involvement was found in any patients, and the distributions of pathological TNM stages and histological types did not differ significantly between the two groups (*Table 1*). In terms of the diagnostic accuracy of the depth of invasion, eight cases (6.3%) were pathological T3 tumors and four (3.2%) were T4 tumors. Among the clinical T1 tumors (n=69), there were 60 cases of pathological T1 (87.0%), five cases of pathological T2 (7.2%), three of pathological T3 (4.3%) and one case of pathological T4 (1.4%). Among the clinical T2 tumors (n=57), there were 42 cases of pathological T1 (73.7%), nine cases of pathological T1 (15.8%), three cases of pathological T3 (5.3%) and three cases of pathological T4 (5.3%).

A total of 23 patients [12 (52.2%) in the LDG group and 11 (47.8%) in the ODG group] received adjuvant chemotherapy, while 10 cases (83.3%) in the LDG group and 10 cases (90.9%) in the ODG group received chemotherapy within 6 weeks following surgery (P=0.59). The mean duration (SD) from surgery to adjuvant chemotherapy was similar between each group; 0.98 (0.41) days in the ODG group and 0.96 (0.46) days in the LDG group (P=0.75).

Survival outcomes

There were 20 deaths (32.8%) in the LDG group and 16 deaths (26.2%) in the ODG group after a median follow-up of 8.31 years, and as shown in *Table 2*, the overall causes of death were similar in both groups. The 5-year overall survival rate was 82.8% (95% CI: 69.4–90.7%) for the ODG group (log-rank P=0.53) and 86.7% (95% CI: 73.9–93.5%) for the LDG group, as shown in *Figure 2*.

As of the deadline, there were 6 deaths (9.2%) due to gastric cancer in the LDG group and 9 (14.8%) in the ODG group. The 5-year cancer-specific survival rate was 88.4% (95% CI: 73.8–95.2%) for the ODG group (log-rank

Table 1 Baseline characteristics of enrolled patients

Variable	LDG (n=65)	ODG (n=61)
Age, mean (SD), years	61 (9.6)	62 (10.9)
BMI, mean (SD), kg/m^2	23.7 (2.8)	23.7 (2.8)
Sex, n (%)		
Male	43 (66.2)	41 (67.2)
Female	22 (33.8)	20 (32.8)
TNM stage, n (%)		
cT1N0M0	50 (76.9)	16 (76.2)
cT1N1M0	1 (1.5)	2 (3.3)
cT2N0M0	14 (21.5)	43 (70.5)
Extent of lymphadenectomy, n (%)		
D1	28 (43.1)	21 (34.4)
D2	37 (56.9)	40 (65.6)
No. of retrieved lymph nodes, n (%)		
≤15	64 (98.5)	60 (98.4)
≥16	1 (1.5)	1 (1.6)
Pathologic T classification, n (%)		
T1	54 (83.1)	48 (78.7)
≥ T2	11 (16.9)	13 (21.3)
Pathologic N classification, n (%)		
N0	56 (86.2)	51 (83.6)
N+	9 (13.8)	10 (16.4)
Pathologic stage, n (%)		
I	57 (87.7)	52 (85.2)
II	5 (7.7)	7 (11.5)
III	2 (3.1)	1 (1.6)
IV	1 (1.5)	1 (1.6)

LDG, laparoscopic distal gastrectomy; ODG, open distal gastrectomy; BMI, body mass index; SD, standard deviation; TNM, Tumor, Node, Metastasis.

P=0.26) and 96.4% (95% CI: 86.2–99.1%) for the LDG group, as shown in *Figure 3*.

Recurrence was seen in 17 cases (26.2%) in the LDG group and 10 cases (16.4%) in the ODG group, with the difference being insignificant (P=0.182). Recurrence patterns were also similar in both groups (*Table 2*). Including patients with mixed recurrence, 6 cases (9.2%) in the LDG group and 5 cases (8.2%) in the ODG group had local recurrence.

Discussion

In the present retrospective study, we confirmed that the 5-year overall survival of gastric cancer patients treated with LDG is not inferior, and its short-term clinical results are better than ODG. The recurrence patterns, cancer-specific survival, and overall survival in an ODG group was similar to that in the LDG group. It was reported in a previous study that LDG was associated with fewer postoperative complications, less blood loss, and a shorter hospital stay (16). Our results show that compared with laparotomy, the early results of laparoscopic surgery are better, or at least similar, and laparoscopic surgery is the least invasive. These long-term oncological results suggest using this surgery to treat clinical stage I gastric cancer is a reasonable alternative to laparotomy.

Inadequate lymph node dissection may increase the risk of local recurrence, causing some scholars to doubt the oncological safety of laparoscopic surgery in the treatment of gastric cancer (17). However, we previously observed that compared with ODG, LDG had the same surgical and pathological oncological efficacy, obtaining both a safe margin of LDG and a sufficient number of lymph nodes. Therefore, we expect their long-term oncological results in terms of overall survival and cancer-specific survival to be comparable, as these early results have demonstrated the oncological safety of laparoscopic surgery. In the present study, although the recurrence rate of the LDG group was higher than that of the ODG group, the difference was not statistically significant. Several other retrospective studies also support our results, in which long-term oncologic outcomes between LDG and ODG groups were observed. Compared with a previous study (18), the survival rate seen in our study was lower, and we hypothesize that this may be due to a relatively lower proportion of pathologic stage IA cancer in our study. Additionally, 16% of patients in our study had lymph node metastasis and 13% had stage II or more advanced cancer.

The quality of our study is high due to our using data from a prospectively maintained database. In conclusion, our results show that the surgical results of both LDG and ODG are satisfactory, and LDG may be a reasonable option for patients with early gastric cancer. In addition, improving lifestyle, such as regular work and rest and reasonable diet

Table 2 Cause of deaths and recurrence patterns

Variables	LDG population (n=65)		ODG population (n=61)		P values
	N	%	N	%	
Total deaths					1.000
Gastric cancer related	3	4.6	3	4.9	
Other malignant tumor related	1	1.5	1	1.6	
Other	3	4.6	3	4.9	
Unknown	1	1.5	1	1.6	
Total recurrence					0.182
Locoregional	2	3.1	4	6.6	
Hematogenous	3	4.6	1	1.6	
Peritoneal	5	7.7	2	3.3	
Distant lymph node	3	4.6	2	3.3	
Mixed	4	6.2	1	1.6	

LDG, laparoscopic distal gastrectomy; ODG, open distal gastrectomy.

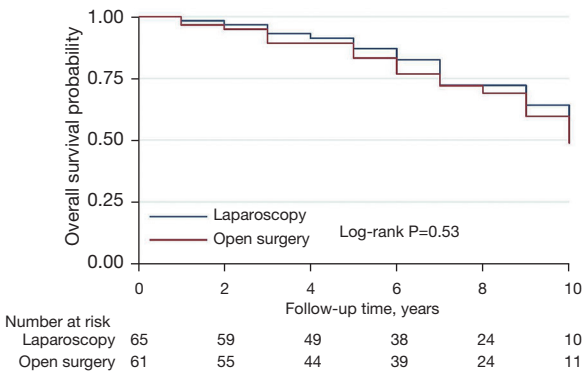

Figure 2 Kaplan-Meier survival curves for overall survival.

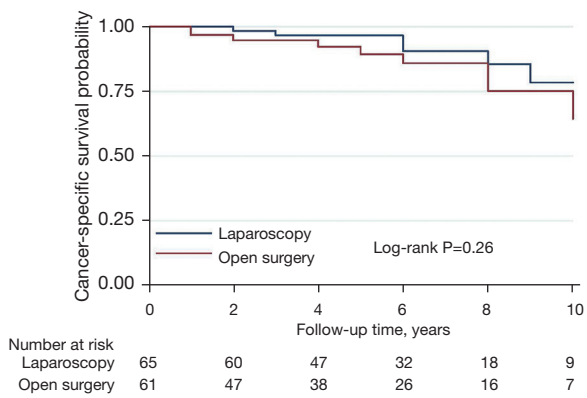

Figure 3 Kaplan-Meier survival curves for cancer-specific survival.

are also very important for the treatment of gastric cancer.

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Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://dx.doi.org/10.21037/jgo-21-782

Data Sharing Statement: Available at https://dx.doi.org/10.21037/jgo-21-782

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://dx.doi.org/10.21037/jgo-21-782). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Ethical approval and individual consent

for this retrospective analysis were waived by the Ethics Committee of our hospital.

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