

Effectiveness of laparoscopic gastrectomy in elderly patients with locally advanced gastric cancer

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ABSTRACT

Introduction: The benefits of laparoscopic gastrectomy in elderly patients with locally advanced gastric cancer remain unclear. The aim of this study was to evaluate the results and feasibility of laparoscopic gastrectomy in patients with locally advanced gastric cancer.

Materials and Methods: We retrospectively reviewed that 461 consecutive patient mean survival follow-up times in elderly patients who underwent laparoscopic gastrectomy were similar to those who underwent open gastrectomy and younger patients who underwent laparoscopic gastrectomy those who underwent curative gastrectomy for locally advanced gastric cancer in our institution between January 2010 and December 2020. Short-term outcomes and mean survival follow-up times were compared between the elderly – young and open – laparoscopic groups.

Results: Except for the length of stay in the hospital and intensive care unit, all outcomes were similar in elderly patients who underwent laparoscopic gastrectomy to those who underwent open gastrectomy. Length of stay in hospital and intensive care unit was significantly shorter in patients who underwent laparoscopic gastrectomy. No significant difference was observed in terms of intensive care unit length of stay, total length of hospital stay, complication rates, mortality rates, and oncologic outcomes between elderly and young patients who underwent laparoscopy.

Conclusion: Laparoscopic surgery is a feasible and safe procedure with acceptable postoperative morbidity and survival rates in elderly patients with locally advanced gastric cancer.

Keywords: Elderly patients, Gastric cancer, Laparoscopic surgery

Introduction

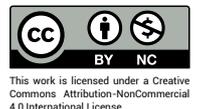
With the developments in medical science, the average life expectancy has enhanced leading to an increase in the elderly population with malignancies and comorbid diseases.^[1-3] It has been shown that approximately 60% of all cancers and 70% of cancer-related deaths occur in pa-

tients over the age of 65.^[4] Because elderly patients have a low tolerance to surgical trauma due to their comorbidities and poor functional capacity, the risk of post-operative complications, morbidity, and mortality is high.^[5-7] Therefore, minimally invasive procedures should be preferred in these patients.^[8,9]



Received: 26.08.2022 Accepted: 15.09.2022

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With the aging of the global population, the number of elderly patients with locally advanced gastric cancer has increased significantly.^[10] The main treatment for locally advanced gastric cancer is surgery. Some studies have shown that laparoscopic gastrectomy can be used safely in locally advanced gastric cancer.^[11-13] It has been shown that gastrectomy can be performed safely in elderly patients with gastric cancer and age alone is not a contraindication.^[14-16] However, the effect of old age on patients undergoing laparoscopic gastrectomy is still unclear, and the number of studies focusing on elderly patients with gastric cancer is limited. This study aimed to evaluate the feasibility and safety of laparoscopic gastrectomy in elderly patients with locally advanced gastric cancer.

Materials and Methods

We retrospectively reviewed 582 patients who underwent curative gastrectomy in our institution between January 2010 and December 2020 for locally advanced gastric cancer. This is a retrospective study, thus no ethical approval was obtained. Cases with a pre-operative diagnosis of locally advanced adenocarcinoma who underwent curative surgery with D2 dissection with complete file data were included in the study. Patients with missing file data, Stage 4 cancer, additional malignant tumors, and the ones who underwent conversion were excluded from the study. After the exclusion, a total of 461 patients were included in the study.

In the literature, the average age of elderly patients with gastric cancer treated with laparoscopic gastrectomy is 65–70 years.^[17,18] Many developed countries consider 65 years of age and older as the elderly population according to the World Health Organization (WHO), thus the age of 65 was chosen as the threshold value in our study. Patients aged 65 and over were considered to be elderly, and patients younger than 65 years of age were considered non-elderly. Short-term outcomes and mean survival follow-up times were compared between the elderly versus non-elderly and open versus laparoscopic groups. Complications occurring within 30 days postoperatively were recorded and classified according to the Clavien-Dindo classification.^[19,20] Data such as age, sex, tumor localization, tumor marker levels, pre-operative laboratory data, type of surgery, length of hospital stay, length of stay in the intensive care unit, stage, number of dissected and positive lymph nodes, post-operative complications, 30-day mortality, and mean survival follow-up were analyzed.

Statistical Analysis

SPSS 11.5 program was used in the analysis of the data. Mean±standard deviation and median (minimum-maximum) were used as descriptive values for quantitative variables and the number of patients (percentage) for qualitative variables. Whether there is a difference between the categories of the qualitative variable and two categories in the quantitative variable were examined using the Student's t test if the normal distribution assumptions are met, and the Mann-Whitney U test if not. Chi-square and Fisher's exact tests were used to examine the relation between two qualitative variables. The statistical significance level was taken as 0.05.

Results

Clinical Demographic and Clinicopathological Features

Two hundred and ninety-five of the patients were male and 166 were female. Two hundred and sixty-five of the patients were in the non-elderly group and 196 in the elderly group. The tumor was mostly located in the antrum (45.5%) and corpus (30.2%), and total gastrectomy was performed in 231 (50.1%) patients. The operation was completed laparoscopically in 84 of the patients. The mean number of lymph nodes dissected was 25.76 and the mean number of metastatic lymph nodes was 8.2. The mean carcinoembryonic antigen value of the patients included in our study was 9.6 ng/ml, and the mean value of carbohydrate antigen 19-9 (CA 19-9) was 74.38 ng/ml. Descriptive clinicopathological features of the patients are summarized in Table 1.

The number of patients over the age of 65 who underwent laparoscopic gastrectomy was 43, and the number of patients who underwent open gastrectomy was 153. The number of patients who underwent laparoscopic gastrectomy in non-elderly patients was 41, and the number of patients who underwent open gastrectomy was 224. Pre-operative mean hemoglobin and albumin levels were significantly lower in elderly patients ($p=0.002$, $p<0.001$, respectively). Mean CA 19-9 levels were significantly higher in elderly patients ($p=0.036$). The mean length of stay in the intensive care unit was 1.89 ± 1.67 days in elderly patients, which was significantly higher ($p=0.008$). The mean number of metastatic lymph nodes was 6.40 ± 7.65 in elderly patients and was significantly lower (<0.001). Mean survival follow-up times in elderly patients were significantly shorter ($p=0.015$). Comparative data of elderly and non-elderly patients are summarized in Table 2.

Table 1. Descriptive clinicopathological features

Variables		Variables	
Age		Median (Min-Max)	1.00 (1.00–27.00)
Mean±SD	60.21±12.87	Total Length of Hospital Stay	
Median (Min-Max)	61.00 (24.00–94.00)	Mean±SD	11.36±6.34
Age, n (%)		Median (Min-Max)	10.00 (1.00–65.00)
Under 65	265 (57.5)	Vascular Invasion, n (%)	
65 and Older	196 (42.5)	No	168 (36.4)
Sex, n (%)		Yes	293 (63.6)
Female	166 (36.0)	Neural Invasion n (%)	
Male	295 (64.0)	No	234 (50.8)
Localization n (%)		Yes	227 (49.2)
Antrum	210 (45.5)	Number of Dissected Lymph Nodes	
Corpus	139 (30.2)	Mean±SD	25.76±11.93
Fundus	5 (1.1)	Median (Min-Max)	25.00 (1.00–79.00)
Cardia	99 (21.5)	Number of Metastatic Lymph Nodes	
Diffuse	8 (1.7)	Mean±SD	8.20±9.20
Pre-operative Hb (g/dL)		Median (Min-Max)	5.00 (0.00–58.00)
Mean±SD	11.92±2.09	Tumor on the Omentum n (%)	
Median (Min-Max)	11.80 (6.50–17.80)	No	425 (92.2)
Pre-operative Albumin (g/dL)		Yes	36 (7.8)
Mean±SD	3.66±1.30	T Stage, n (%)	
Median (Min-Max)	3.70 (0.36–27.70)	T3	44 (9.5)
CEA (ng/mL)		T4	417 (90.6)
Mean±SD	9.60±41.98	Stage, n (%)	
Median (Min-Max)	2.18 (0.25–716.00)	2a	6 (1.3)
CA 19-9 (U/mL)		2b	73 (15.8)
Mean±SD	74.38±218.05	2c	1 (0.2)
Median (Min-Max)	15.10 (0.60–1875.90)	3a	171 (37.1)
CA 125		3b	114 (24.7)
Mean±SD	20.26±24.36	3c	95 (20.6)
Median (Min-Max)	12.82 (2.00–184.00)	Adjuvant KT, n (%)	
CA 15-3		No	101 (26.2)
Mean±SD	17.52±61.69	Yes	285 (73.8)
Median (Min-Max)	10.90 (2.10–841.90)	Adjuvant RT, n (%)	
CA 72-4 (U/mL)		No	256 (66.7)
Mean±SD	28.78±141.31	Yes	128 (33.3)
Median (Min-Max)	2.27 (0.20–1383.00)	Overall Survival	
AFP (ng/mL)		Mean±SD	38.25±43.59
Mean±SD	8.02±26.02	Median (Min-Max)	21.00 (0.00–192.00)
Median (Min-Max)	2.28 (0.50–302.97)	Mortality, n (%)	
Type of the Surgery n (%)		Yes	340 (73.8)
Laparoscopic	84 (18.2)	No	121 (26.2)
Open	377 (81.8)	Complications, n (%)	
Type of the Surgical Resection, n (%)		No	266 (78.9)
Total	231 (50.1)	Yes	71 (21.1)
Subtotal	225 (48.8)	30-Day Mortality, n (%)	
Proximal	5 (1.1)	No	409 (88.7)
Length of Stay in The Intensive Care Unit		Yes	52 (11.3)
Mean±SD	1.74±1.91		

SD: Standard deviation.

Table 2. Comparative data of elderly and non-elderly patients

Variables	Age		p
	Elderly	Non-Elderly	
Sex, n(%)			
Female	97 (36.6)	69 (35.2)	0.757a
Male	168 (63.4)	127 (64.8)	
Localization, n(%)			
Antrum	126 (47.5)	84 (42.9)	0.845b
Corpus	75 (28.4)	64 (32.7)	
Fundus	3 (1.1)	2 (1.0)	
Cardia	56 (21.1)	43 (21.9)	
Diffuse	5 (1.9)	3 (1.5)	
Pre-operative Hb (g/dL)			
Mean±SD	12.20±2.18	11.54±1.90	0.002c
Median (Min-Max)	12.00 (7.40–17.80)	11.30 (6.50–16.20)	
Pre-operative Albumin (g/dL)			
Mean±SD	3.70±0.68	3.60±1.83	<0.001c
Median (Min-Max)	3.80 (0.36–4.90)	3.50 (1.80–27.70)	
CEA (ng/mL)			
Mean±SD	10.16±50.34	8.84±26.88	0.391c
Median (Min-Max)	2.16 (0.25–716.00)	2.19 (0.34–284.60)	
CA 19-9 (U/mL)			
Mean±SD	59.80±175.03	94.05±264.58	0.036c
Median (Min-Max)	13.10 (0.60–1875.90)	18.00 (0.67–1848.00)	
CA 125			
Mean±SD	21.23±22.85	19.27±25.92	0.386c
Median (Min-Max)	13.77 (2.00–141.30)	12.60 (2.50–184.00)	
CA 15-3			
Mean±SD	19.66±81.40	15.10±25.47	0.173c
Median (Min-Max)	10.00 (2.10–841.90)	11.60 (2.10–243.50)	
CA 72-4 (U/mL)			
Mean±SD	42.01±184.53	11.20±29.91	0.380c
Median (Min-Max)	1.90 (0.60–1383.00)	2.49 (0.20–237.00)	
AFP (ng/mL)			
Mean±SD	7.25±24.83	9.19±27.77	0.886c
Median (Min-Max)	2.28 (0.67–302.97)	2.25 (0.50–231.30)	
Neoadjuvant KT, n (%)			
No	230 (88.5)	176 (91.2)	0.346a
Yes	30 (11.5)	17 (8.8)	
Type of the Surgery, n (%)			
Laparoscopic	41 (15.5)	43 (21.9)	0.075a
Open	224 (84.5)	153 (78.1)	
Type of the Surgical Resection n (%)			
Total	137 (51.7)	94 (48.0)	0.772b
Subtotal	125 (47.2)	100 (51.0)	
Proximal	3 (1.1)	2 (1.0)	

Table 2. CONT.

Variables	Age		p
	Elderly	Non-Elderly	
Length of Stay in The Intensive Care Unit			
Mean±SD	1.62±2.07	1.89±1.67	0.008c
Median (Min-Max)	1.00 (1.00–27.00)	1.00 (1.00–12.00)	
Total Length of Hospital Stay			
Mean±SD	11.42±6.36	11.28±6.33	0.614c
Median (Min-Max)	10.00 (1.00–65.00)	10.00 (2.00–50.00)	
Vascular Invasion, n (%)			
No	101 (38.1)	67 (34.2)	0.386a
Yes	164 (61.9)	129 (65.8)	
Neural Invasion, n (%)			
No	131 (49.4)	103 (52.6)	0.508a
Yes	134 (50.6)	93 (47.4)	
Number of Dissected Lymph Nodes			
Mean±SD	26.56±12.49	9.52±10.01	0.229c
Median (Min-Max)	25.00 (1.00–79.00)	6.00 (0.00–49.00)	
Number of Metastatic Lymph Nodes			
Mean±SD	11.42±6.36	6.40±7.65	<0.001c
Median (Min-Max)	10.00 (1.00–65.00)	4.00 (0.00–58.00)	
Tumour on the Omentum n (%)			
No	240 (90.6)	185 (94.4)	0.131a
Yes	25 (9.4)	11 (5.6)	
T Stage, n (%)			
T3	26 (9.8)	18 (9.2)	0.821a
T4	239 (90.2)	178 (90.8)	
Stage, n (%)			
2a	2 (0.8)	4 (2.0)	0.612b
2b	39 (14.7)	34 (17.3)	
2c	0 (0.0)	1 (0.5)	
3a	97 (36.6)	74 (37.8)	
3b	69 (26.0)	45 (23.0)	
3c	57 (21.5)	38 (19.4)	
4	1 (0.4)	0 (0.0)	
Adjuvant KT, n (%)			
No	50 (21.7)	51 (32.7)	0.016a
Yes	180 (78.3)	105 (67.3)	
Adjuvant RT, n (%)			
No	151 (65.9)	105 (67.7)	0.713a
Yes	78 (34.1)	50 (32.3)	
Overall Survival			
Mean±SD	41.03±43.99	34.74±42.89	0.015c
Median (Min-Max)	22.00 (0.00–180.00)	16.00 (0.00–192.00)	
Mortality, n (%)			
No	73 (27.5)	48 (24.5)	0.461a
Yes	192 (72.5)	148 (75.5)	
Complications, n (%)			
No	153 (81.8)	113 (75.3)	0.147a
Yes	34 (18.2)	37 (24.7)	

Post-operative Results

The post-operative complication rate in patients over 65 years of age who underwent laparoscopic gastrectomy was statistically similar to those over 65 years of age with gastric cancer who underwent open gastrectomy ($p=0.328$). In elderly patients who underwent laparoscopic gastrectomy, the average length of stay in the intensive care unit was 1.55 ± 1.40 days, which was statistically significantly lower than the group that underwent open gastrectomy ($p=0.008$). The mean total hospital stay was 10.51 ± 7.46 days in elderly patients who underwent laparoscopic gastrectomy, which was statistically significantly lower than the group that underwent open gastrectomy ($p=0.016$). The mean number of lymph nodes dissected in elderly patients who underwent laparoscopic gastrectomy was 23.7 ± 8.76 , which was similar to the group that underwent open gastrectomy (24.96 ± 11.63) ($p=0.51$). In elderly patients who underwent laparoscopic gastrectomy, the mean survival follow-up times were similar to those who underwent open gastrectomy (36.73 ± 36.38 months and 34.18 ± 44.64 months, respectively) ($p=0.087$). Surgical

results and post-operative complication rates according to the surgical procedure applied to elderly patients are summarized in Table 3.

No significant difference was found in terms of the length of stay in the intensive care unit, the total length of hospital stay, complication rates, mortality rates, and oncologic outcomes between elderly and non-elderly groups who underwent laparoscopic gastrectomy (all $p>0.05$). In elderly patients who underwent laparoscopic gastrectomy, the mean intensive care unit stay was 1.55 ± 1.40 days, which was similar to the non-elderly group ($p=0.724$). In elderly patients who underwent laparoscopic gastrectomy, the mean total hospital stay was 10.51 ± 7.46 days, which was similar to the non-elderly group ($p=0.899$). The mean number of dissected lymph nodes in elderly patients who underwent laparoscopic gastrectomy was 23.70 ± 8.76 , which was similar to the non-elderly group ($p=0.854$). The complication rate in elderly patients who underwent laparoscopic gastrectomy was 18.2% and was similar to the non-elderly group ($p=0.328$). A total of 4 (9.3%) deaths occurred in the first 30 days in the elderly

Table 3. Comparisons of surgery types in patients over 65 years of age

Variables	Type of the Surgery		p
	Laparoscopic	Open	
Length of Stay in The Intensive Care Unit			
Mean±SD	1.55±1.40	2.00±1.74	0.008b
Median (Min-Max)	1.00 (1.00–8.00)	1.00 (1.00–12.00)	
Number of Dissected Lymph Nodes			
Mean±SD	23.70±8.76	24.96±11.63	0.510a
Median (Min-Max)	22.00 (9.00–41.00)	25.00 (1.00–63.00)	
Number of Metastatic Lymph Nodes			
Mean±SD	6.16±6.51	6.47±7.96	0.721b
Median (Min-Max)	2.00 (0.00–21.00)	4.00 (0.00–58.00)	
Overall Survival			
Mean±SD	36.73±36.38	34.18±44.64	0.087b
Median (Min-Max)	33.00 (0.10–164.00)	13.00 (0.00–192.00)	
Total Length of Hospital Stay			
Mean±SD	10.51±7.46	11.49±5.98	0.016b
Median (Min-Max)	9.00 (2.00–43.00)	10.00 (2.00–50.00)	
Complications, n (%)			
No	27 (81.8)	86 (73.5)	0.328c
Yes	6 (18.2)	31 (26.5)	
30-Day Mortality, n (%)			
No	39 (90.7)	127 (83.0)	0.216c
Yes	4 (9.3)	26 (17.0)	

group who underwent laparoscopic gastrectomy. Two of these were due to surgical complications and two of them were due to cardiopulmonary reasons. No statistically significant difference was found between elderly and non-elderly groups ($p=0.676$).

In elderly patients who underwent laparoscopic gastrectomy, the mean survival follow-up period was 36.73 ± 36.38 months, which was similar to the non-elderly group ($p=0.223$). Comparisons of elderly and non-elderly patients who underwent laparoscopy are summarized in Table 4.

Discussion

Although the feasibility of laparoscopic gastrectomy in elderly patients is controversial, its use has been increasing in recent years. Therefore, we planned this study to evaluate the safety and efficacy of laparoscopic gastrectomy in elderly patients with locally advanced gastric cancer. In our study, we aimed to address two questions: Can laparoscopic surgery be performed as safely in elderly pa-

tients with locally advanced gastric cancer as in elderly patients who underwent open surgery and non-elderly patients who underwent laparoscopic surgery? Our study showed that laparoscopic surgery in elderly patients with locally advanced gastric cancer is not associated with increased morbidity and has acceptable outcomes in terms of survival. It was found that the short-term results of the group that underwent laparoscopic gastrectomy in elderly patients were better than the group that underwent open gastrectomy.

In recent years, radical surgery has started to be used more commonly in elderly patients with gastric cancer. In a study, it was suggested that advanced age is an important factor that increases post-operative comorbidities; therefore, more attention should be paid to the effect of advanced age on clinical outcomes, but age is not a definite contraindication for surgery.^[21] In a meta-analysis, it was found that age alone was not a determinant for radical or palliative treatment in elderly patients with gastric cancer and that the organ function, physical, social, and mental status of the patients were also important factors.

Table 4. Age-related comparisons in patients who underwent laparoscopic gastrectomy

Variables	Age Group		p
	Non-Elderly	Elderly	
Length of Stay in The Intensive Care Unit			
Mean±SD	1.34±0.96	1.55±1.40	0.724b
Median (Min-Max)	1.00 (1.00–6.00)	1.00 (1.00–8.00)	
Number of Dissected Lymph Nodes			
Mean±SD	24.05±8.69	23.70±8.76	0.854a
Median (Min-Max)	22.00 (8.00–52.00)	22.00 (9.00–41.00)	
Number of Metastatic Lymph Nodes			
Mean±SD	6.24±7.01	6.16±6.51	0.708b
Median (Min-Max)	3.00 (0.00–30.00)	2.00 (0.00–21.00)	
Overall Survival			
Mean±SD	40.09±26.62	36.73±36.38	0.223b
Median (Min-Max)	36.00 (0.20–100.00)	33.00 (0.10–164.00)	
Total Length of Hospital Stay			
Mean±SD	10.17±6.59	10.51±7.46	0.899b
Median (Min-Max)	9.00 (4.00–45.00)	9.00 (2.00–43.00)	
Complications, n (%)			
No	24 (85.7)	27 (81.8)	0.328c
Yes	4 (14.3)	6 (18.2)	
30-Day Mortality, n (%)			
No	39 (95.1)	39 (90.7)	0.676c
Yes	2 (4.9)	4 (9.3)	

^[22] Randomized studies have shown that laparoscopic gastrectomy in gastric cancer can provide short and long-term results similar to open surgery.^[23,24] In many studies, it has been reported that there is no difference in the rates of post-operative complications in elderly patients despite the high prevalence of cardiovascular disease, decreased respiratory function, and high American Society of Anaesthesiologists scores.^[25-27] In our study, the post-operative complication rate in elderly patients who underwent laparoscopic gastrectomy was statistically similar to elderly patients who underwent open gastrectomy and non-elderly patients with gastric cancer who underwent laparoscopic gastrectomy. However, the complication rate in laparoscopic cases was 18.2%, which was higher than the literature. We think that this is because the surgery of locally advanced patients was more complicated and the inclusion of the first laparoscopic cases in our learning curve in the study. Compared with open surgery, laparoscopic gastrectomy is associated with less intraoperative blood loss, less pain, faster recovery from surgery, and similar long-term outcomes.^[28-32] Moreover, laparoscopic surgery has now become a standard, especially in early-stage gastric cancer, due to shorter hospital stays, lower postoperative complication rates, less pain, and early return to work.^[33] There are also studies showing that laparoscopic gastrectomy significantly reduces both surgical and systemic morbidity compared to open gastrectomy.^[34] In a study investigating the safety of laparoscopic gastrectomy in elderly patients, it was concluded that the post-operative mortality rate was not affected by age.^[4] In our study, we observed that the post-operative hospital and intensive care unit stays were significantly shorter in elderly patients who underwent laparoscopic gastrectomy compared to open surgery ($p=0.016$ and $p=0.08$, respectively). We did not observe a significant difference in mortality rates between elderly and non-elderly groups who underwent laparoscopic gastrectomy ($p=0.676$).

The number of lymph nodes dissected is considered an important indicator of gastrectomy quality in gastric cancer. D2 lymphadenectomy is the standard in the treatment of locally advanced gastric cancer.^[35] However, the extent of lymphadenectomy in elderly patients is still controversial. Some surgeons are reluctant to perform D2 lymphadenectomy in elderly patients because of morbidity concerns. In several studies, it has been reported that D2 dissection does not provide a significant survival advantage over D1 dissection in elderly patients.^[36-38] As a high-volume and experienced center in terms of gastric cancer,

we did not have the opportunity to compare D1 and D2 lymphadenectomy, as we performed standard D2 dissection in our clinic. We think that D2 lymphadenectomy may improve prognosis, reduce the risk of tumor recurrence and metastasis, and prolong survival in locally advanced gastric cancers. However, we are aware that extended D2 dissection may increase morbidity in elderly patients. In our study, the number of lymph nodes dissected was statistically similar in all groups. We think that large randomized studies are needed to determine the optimal extent of lymph node dissection and individual strategies for the treatment in elderly patients.

The number of studies investigating the survival outcomes in elderly gastric cancers who underwent laparoscopic gastrectomy is limited. In the studies performed, no significant difference was observed in terms of overall survival between the elderly and non-elderly groups who underwent laparoscopic gastrectomy.^[34,39] In a study, similar 2-year survival rates were reported between the laparoscopic and open groups in terms of survival in elderly patients.^[40] However, there are also studies indicating that the overall survival is shorter in elderly patients.^[4,26] In our study, the mean survival follow-up times in elderly patients who underwent laparoscopic gastrectomy were similar to those who underwent open gastrectomy and non-elderly patients who underwent laparoscopic gastrectomy.

Our study has some limitations that may affect the results. The most important limitation of our study is that it is retrospective and single-centered. In addition, the results of the laparoscopic group may have been adversely affected, as the first laparoscopic cases in our learning curve were among the cases included. However, given the limited data in the literature about laparoscopic gastrectomy in elderly patients with locally advanced gastric cancer and the large number of patients included in the study, we think that this study is valuable for surgeons dealing with gastric cancer.

In summary, laparoscopic surgery for elderly patients with locally advanced gastric cancer is as safe as open surgery for elderly patients and laparoscopic surgery for non-elderly patients, with acceptable post-operative morbidity and survival rates. To prevent post-operative complications, attention should be paid to perioperative care in this patient group. More studies are needed to develop individual strategies for the treatment and management of advanced age locally advanced gastric carcinomas in the future.

Disclosures

Ethics Committee Approval: This is a retrospective study, thus no ethical approval was obtained.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – S.C.; Design – S.T.; Supervision – S.D.; Materials – A.E.U.; Data collection and/or processing – C.A.; Analysis and/ or interpretation – S.C.; Literature search – Z.K.; Writing – S.C., S.T.; Critical review – A.E.U., S.D.

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