JBUON 2018; 23(1): 85-91
ISSN: 1107-0625, online ISSN: 2241-6293 • www.jbuon.com
E-mail: editorial_office@jbuon.com

ORIGINAL ARTICLE

Outcomes of laparoscopic gastrectomy for gastric cancer in elderly patients

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Summary

Purpose: *This study aimed to compare the short- and long-term outcomes of elderly and middle-aged patients with gastric cancer who underwent laparoscopic gastrectomy.*

Methods: *From January 2010 to February 2017, a total of 75 patients with gastric cancer aged ≥70 years (elderly group) underwent laparoscopic gastrectomy, and their short- and long-term outcomes were compared with those of 197 patients with gastric cancer aged 60–69 years (middle-aged group) who underwent also laparoscopic gastrectomy during the same period.*

Results: *With respect to the patients' preoperative baseline characteristics, the elderly group had a higher Charlson comorbidity index score, rate of previous abdominal operations, and American Society of Anesthesiologists (ASA) classification score compared to middle-aged patient group. There were no significant differences in the other baseline characteristics. There were no significant between-groups differences in the duration of surgery, intraoperative blood loss, incidence and severity of 30-day postoperative complications, and pathological results. Long-term follow-up results showed that the tumor recurrence rates were similar between groups, as were the overall (OS) and disease-free survival (DFS) rates. Multivariate analysis showed that age was not an independent predictor of OS and DFS.*

Conclusion: *In summary, laparoscopic gastrectomy in elderly patients with gastric cancer can achieve similar short- and long-term outcomes as those for middle-aged patients. Age is thus not a contraindication for laparoscopic gastrectomy.*

Key words: *elderly, gastric carcinoma, laparoscopic gastrectomy, minimally invasive surgery, prognosis*

Introduction

As medical science has progressed and the standard of living has increased, life expectancy in China has recently shown an increasing trend [1]. China is now becoming an ageing society. Gastric cancer is one of the common malignant tumors, and as life expectancy has increased, the incidence of gastric cancer in the elderly has also shown an increasing trend [2-5]. Surgical resection is the main method of treatment for patients with gastric cancer [6-9]. However, as elderly patients often have many medical comorbidities and poor functional capacity, the incidence of postoperative complications and the mortality rate are higher in elderly patients with gastric cancer after surgical resection [10-13]. Studies have shown that, compared with open gastrectomy, laparoscopic gastrectomy has advantages, such as less surgical trauma and shorter hospital stay, when used in elderly patients with gastric cancer [14-21]. However, the primary factor for evaluating new tumor resection procedures is whether long-term outcomes (including OS, DFS and disease recurrence) are comparable with those for open surgery. Currently, there are only a few reports on the long-term outcomes of laparoscopic gastrectomy in elderly patients with gastric cancer [14,17,20,21]. Hence, this study aimed to compare the short- and long-term outcomes of elderly and middle-aged patients who underwent laparoscopic gastrectomy.

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Received: 08/07/2017; Accepted: 19/07/2017

Methods

From January 2010 to February 2017, a total of 75 patients with gastric cancer aged ≥70 years underwent laparoscopic gastrectomy and were included in the elderly group. During the same period, a total of 197 patients with gastric cancer aged 60–69 years who underwent also laparoscopic gastrectomy were included in the middle-aged group. All patients underwent also electronic gastroscopy, endoscopic ultrasound, computed tomography (CT) of the brain, chest, and abdomen, and abdominal ultrasound to determine the clinical disease stage and to exclude metastasis. Positron emission tomography-computed tomography (PET-CT) and bone scans were performed when necessary. Lung function tests, electrocardiography, Doppler echocardiography, and other tests were performed to evaluate heart and lung function in patients before surgery [22-24]. The surgical indication for laparoscopic gastrectomy was stage cT1-3N0-1M0 [25]. Detailed surgical procedures have been previously reported [17].

The severity of 30-day postoperative complications was graded using the Clavien-Dindo classification, which ranks the severity of postoperative complications into 5 grades [26-30]. Mild complications are classified as grades 1 and 2, while severe complications are classified as grades 3, 4, and 5 [31-33]. Patients with a pathological stage ≥II were recommended to undergo postoperative adjuvant chemotherapy if there were no contraindications for chemotherapy [24,25].

After patients were discharged, follow-up visits were carried out through outpatient consultations, telephone interviews, house visits, and/or communication with community hospitals. Follow-ups were carried out once every 3 months in the first year after surgery, once every 4 months in the second year, once every 6 months in the third year, and once a year thereafter. As all patients were local residents, the rate of follow-up was 100%. The last follow-up was conducted on March 10, 2017. The research was approved by our local ethics committee. The requirement of informed consent from patients was waived because of the retrospective nature of the research.

Statistics

Data are presented as means and standard deviations for variables with a normal distribution. For data with a non-normal distribution, results are expressed as medians and ranges. Survival rates were analyzed using the Kaplan-Meier method and comparisons were performed with log-rank test. Univariate analyses were performed to identify prognostic variables related to OS and DFS and also to identify prognostic variables related to conversion. Univariate variables with probability values <0.10 were selected for inclusion in the multivariate Cox proportional hazard regression model. $P < 0.05$ was considered statistically significant and the SPSS 14.0 (SPSS Inc., Chicago, IL, USA) software for Windows was used for all statistical analyses.

Results

Comparing the preoperative baseline characteristics of patients (Table 1), patients in the elderly group had a higher Charlson comorbidity index (p=0.030), rate of previous abdominal surgery (p=0.003), and ASA classification score (p=0.020)

Table 1. Baseline characteristics of the two groups

	Middle-aged group (n=197) n (%)	*Elderly group (n= 75) n (%)*	*p value*
Age (years)	67 (60-69)	74 (70-78)	0.000
Sex			0.723
Male	128 (65.0)	47 (62.7)	
Female	69 (35.0)	28 (37.3)	
Charlson comorbidity index			0.030
≤ 2	154 (78.2)	49 (65.3)	
> 2	43 (21.8)	26 (34.7)	
BMI (kg/m^2)	19-30	17-28	0.106
Previous abdominal surgery	18 (9.1)	17 (22.7)	0.003
Clinical TNM stage			0.107
IB	24 (12.2)	16 (21.3)	
IIA	76 (38.6)	28 (37.3)	
IIB	97 (49.2)	31 (41.3)	
ASA score			0.020
I	121 (61.4)	38 (50.7)	
II	48 (24.4)	13 (17.3)	
III	28 (14.2)	24 (32.0)	

BMI: body mass index, ASA: American Society of Anesthesiologists

than patients in the middle-aged group. There were no significant differences in other baseline characteristics.

The short-term outcomes for patients in both groups are shown in Table 2. There were no significant differences in the duration of operation, intraoperative blood loss, conversion rate, intraoperative and postoperative transfusion rates, length of hospital stay, or the incidence and severity of postoperative 30-day complications between groups. No patient died during surgery or within 30 days of surgery in either group. There were no significant between-groups differences in pathological results (Table 3).

The median follow-up period was 37 months and 40 months in the elderly and middle-aged groups, respectively, which were not significantly different (p=0.650). During the follow-up period, 31 patients in the elderly group died, of which 28 died due to tumor relapse and 3 died due to non-tumor-related reasons (two due to ischemic stroke and one due to ST-segment elevation myocardial infarction). There were 53 deaths in the middle-aged group, of which 48 were due to tumor relapse and 5 were due to non-tumor-related reasons. The 5-year OS rates were 52% and 56% in the elderly and middle-aged groups, respectively, which were not significantly different (p=0.083; Figure 1). Multivariate analysis showed that T stage and N stage were independent predictors affecting OS (Tables 4 and 5).

There were 32 and 53 patients who had tumor recurrence in the elderly and middle-aged groups, respectively. The 5-year DFS rates were 41% and 44% in the elderly and middle-aged groups, respectively, which were not significantly different (p=0.079; Figure 2). Multivariate analysis showed that N stage and tumor differentiation were independent predictors of DFS (Tables 6 and 7). Age was not found to be an independent predictor of OS and DFS).

Table 2. Short-term outcomes of the two groups

Outcomes	*Middle-aged group (n=197) n (%)*	*Elderly group (n= 75) n (%)*	*p value*
Operative time, min (range)	190 (150-280)	170 (150-260)	0.098
Surgical method			0.343
Distal gastrectomy	82 (41.6)	36 (48.0)	
Total gastrectomy	115 (58.4)	39 (52.0)	
Estimated blood loss, ml (range)	190 (160-300)	200 (170-330)	0.087
Conversion to open surgery	11 (5.6)	6 (8.0)	0.649
Blood transfusion	16 (8.1)	9 (12.0)	0.322
Patients with postoperative 30-day complications	34 (17.3)	16 (21.3)	0.438
Patients with postoperative 30-day major complications	11 (5.6)	5 (6.7)	0.959
Postoperative hospital stay, days (range)	9 (8-25)	11 (7-23)	0.103

Table 3. Short-term oncological data of the two groups

	Middle-aged group (n=197) n (%)	*Elderly group (n= 75) n (%)*	*p value*
Retrieved lymph nodes	18 (16-23)	16 (15-19)	0.092
Residual tumor (R0/R1/R2)	193/4/0 (98.2/2.0/0.0)	74/1/0 (98.7/1.3/0.0)	0.703
Histological subtype			0.794
Differentiated	78 (40.0)	31 (41.3)	
Undifferentiated	119 (60.0)	44 (58.7)	
Pathological TNM stage			0.229
IB	11 (5.6)	5 (6.7)	
IIA	59 (30.0)	29 (38.7)	
IIB	45 (22.8)	15 (20.0)	
IIIA	39 (19.8)	11 (14.7)	
IIIB	24 (12.2)	8 (10.7)	
IIIC	19 (9.6)	7 (9.3)	

Table 4. Univariate analysis of overall survival

Variables	*5-year overall survival (%)*	*p value*
Age (years)		0.086
60-69	56	
≥70	52	
Gender		0.257
Male	59	
Female	53	
Charlson comorbidity index		0.100
≤ 2	58	
> 2	51	
ASA score		0.184
I-II	61	
III	53	
Histological subtype		0.044
Differentiated	58	
Undifferentiated	46	
Pathological T stage		0.014
1-2	69	
3-4	41	
Pathological N stage		0.024
0-1	64	
2-3	44	
Surgical method		0.257
Distal gastrectomy	58	
Total gastrectomy	54	
BMI		0.196
≤ 25kg/m^2	59	
> 25kg/m^2	48	

For abbreviations see footnote of Table 1

Table 6. Univariate analysis of disease-free survival

Variables	*5-year disease free survival (%)*	*p value*
Age, years		0.079
60–69	44	
≥70	41	
Gender		0.159
Male	47	
Female	39	
Charlson comorbidity index		0.187
≤ 2	46	
> 2	38	
ASA score		0.367
I-II	46	
III	38	
Histological subtype		0.009
Differentiated	51	
Undifferentiated	37	
Pathological T stage		0.027
1-2	51	
3-4	35	
Pathological N stage		0.003
0-1	53	
2-3	31	
Surgical method		0.310
Distal gastrectomy	46	
Total gastrectomy	41	
BMI		0.110
≤ 25kg/m^2	48	
> 25kg/m^2	40	

For abbreviations see footnote of Table 1

Table 5. Cox proportional hazards model for overall survival

Variables	*Hazard ratio (95% CI)*	*p value*
Age, 60–69 years vs ≥70 years	1.159 (0.687-1.580)	0.217
Histological subtype, Differentiated vs undifferentiated	1.279 (0.558-1.770)	0.258
Pathological T stage, 1-2 vs 3-4	2.980 (1.558-3.985)	0.016
Pathological N stage, 0-1 vs 2-3	2.056 (1.466-2.874)	0.028

Table 7. Cox proportional hazards model for disease-free survival

Variables	*Hazard ratio (95% CI)*	*p value*
Age, 60–69 years vs ≥70 years	1.087 (0.487-1.320)	0.319
Histological subtype, Differentiated vs undifferentiated	1.700 (1.303-2.106)	0.031
Pathological T stage, 1-2 vs 3-4	1.397 (0.781-1.980)	0.109
Pathological N stage, 0-1 vs 2-3	2.541 (1.601-2.904)	0.014

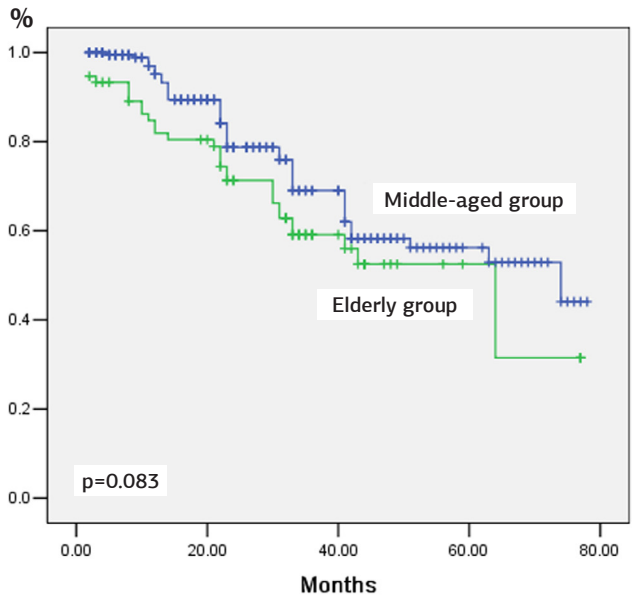

Figure 1. Comparison of overall survival rate between middle-aged and elderly group.

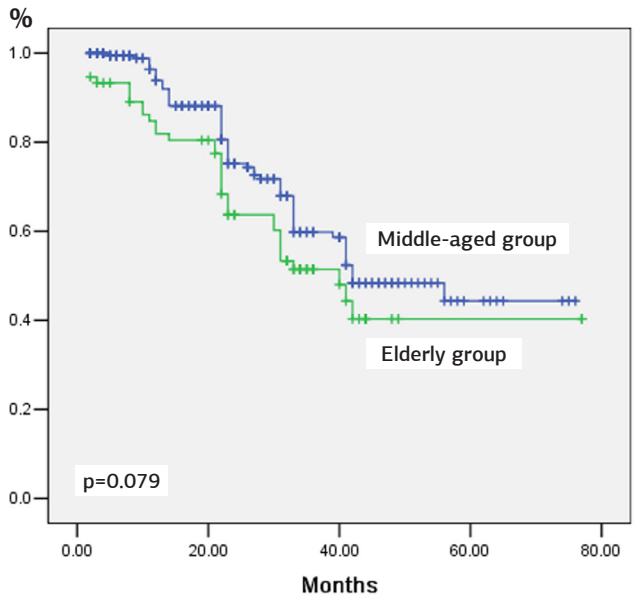

Figure 2. Comparison of disease-free survival rate between the middle-aged and elderly group.

Discussion

In an ageing society, the use of surgery for treating gastric cancer in elderly patients has increased [34,35]. Some studies have shown that it is safe to conduct gastrectomies in elderly gastric patients, but as elderly patients have many medical comorbidities and insufficient heart and lung functional capacity, higher postoperative complication and mortality rates were also observed [3,34,35]. This difference is also a reason why the ratio of elderly gastric cancer patients is lower than that of non-elderly patients. Since 1994 when Kitanto et al. reported the first use of laparoscopic gastrectomy in the treatment of gastric cancer [36], it has become widely used globally due to its minimally invasive nature and similar oncological outcomes as those for open gastrectomy [20-23]. Randomized controlled trials have shown that, compared with open gastrectomy, laparoscopic gastrectomy has advantages, such as smaller incisions, less intraoperative blood loss, shorter hospital stay and lower postoperative complication and mortality rates [37-39].

In recent years, due to the accumulation of surgical experience, improvements in equipment and promotion of laparoscopic operations by relevant academic organizations, laparoscopic gastrectomy has been gradually developed in many medical centers for the treatment of gastric cancer [37-39]. Due to its advantage of being minimally invasive, there has been a number of studies on the use of laparoscopic gastrectomy in the treatment of elderly gastric cancer patients [14-21]. Most of these studies were focused on short-term outcomes, with only a few studies focusing on long-term outcomes [14,17,20,21]. The results of our study showed that even though elderly patients had a higher Charlson comorbidity index, rate of previous abdominal operations, and ASA score, the short- and long-term outcomes of laparoscopic gastrectomy in elderly gastric cancer patients were similar to those for middle-aged patients and multivariate analysis showed that age was not an independent predictor of OS or DFS in these patients.

In this study, the proportion of elderly patients with a history of abdominal operations was compared with the middle-aged group, but the conversion rates were similar between groups, at 8% and 6%, respectively. Previous large-sample studies have reported conversion rates of 1–12%, consistent with the results of our study [14,17,20,21]. In the present study, the reason for conversion to open gastrectomy in the majority of patients was that during surgery the tumor stage was found to be more advanced and because it is difficult to carry out R0 resection with laparoscopy, conversion to open gastrectomy was decided and performed. A minority of patients were converted to open gastrectomy due to technical factors, such as obesity, bleeding, adhesions, and others. Our results suggest that even though the proportion of elderly patients with past abdominal operations was higher compared to the middle-aged patients, as long as the physician is sufficiently skilled, a low conversion rate to open gastrectomy can still be achieved.

One reason that the proportion of elderly gastric cancer patients undergoing laparoscopic

gastrectomy is lower than that for middle-aged patients is due to the surgeon's concern about whether elderly patients can tolerate pneumoperitoneum [3]. Pneumoperitoneum could result in an increase in intraperitoneal pressure and carbon dioxide retention in the blood, theoretically resulting in heart and lung complications [3,14,17]. However, in this study, no cardiac complications were observed in elderly patients, while 3 elderly patients had lung infections that fully resolved after intravenous antibiotic administration; thus, this complication was classified as mild according to the Clavien–Dindo classification criteria. None of the patients had severe cardiac or lung complications (such as pulmonary embolism or myocardial infarction). Hence, as long as the operation was conducted appropriately and intensive postoperative monitoring was carried out, adverse events such as pneumoperitoneum could be avoided.

Past studies of elderly gastric cancer patient who had laparoscopic gastrectomy have shown a 5-year OS and DFS rates of 48–66% and 43–58%, respectively [14,17,20,21]. The 5-year OS and DFS in our study were similar to those of previous studies as well as to those of middle-aged patients. The cause of death in the majority of elderly patients in our study was tumor recurrence, while a minority was due to non-tumor-related illnesses. This result showed that, as long as laparoscopy is surgically indicated, laparoscopic gastrectomy could obtain similar long-term outcomes for elderly and middle-aged patients. This similarity is because in gastric cancer patients, the 5-year survival rate of patients who did not undergo surgery is 0%. Currently in China, the predicted life expectancy of the elderly population is showing an increasing trend; hence, advanced age has not remained a bottleneck for radical resection in gastric cancer patients.

The present study has several limitations. Firstly, it was a retrospective study, not a randomized controlled study; a prospective randomized controlled study is needed to demonstrate that laparoscopic surgery in elderly patients is truly a feasible procedure for gastric cancer. Secondly, as this study was a single-center study, the generalization of the results to other patients is potentially limited.

Conclusion

The results of this study showed that laparoscopic gastrectomy in elderly gastric cancer patients did not increase the rate of postoperative 30-day complications or the mortality rate, and similar long-term outcomes for middle-aged patients were obtained. For elderly gastric cancer patients, advanced age is not a contraindication for laparoscopic gastrectomy.

Acknowledgement

We sincerely thank our hospital colleagues who participated in this research.

Conflict of interests

The authors declare no conflict of interests.

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