Original Article

The clinical features, management, and survival of elderly patients with gastric cancer

Lei Shen[1#], Xiaomei Zhang[1#], Lu Kong[2#], Yifei Wang[3]

[1]Department of Gastroenterology, the First Medical Center of People's Liberation Army General Hospital, Beijing, China; [2]Patient Management Department, the Fourth Medical Center of People's Liberation Army General Hospital, Beijing, China; [3]Medical Big-Data Research Center, Medical Innovation Research Division, People's Liberation Army General Hospital, Beijing, China

Contributions: (I) Conception and design: L Shen; (II) Administrative support: X Zhang, L Kong; (III) Provision of study materials or patients: L Shen; (IV) Collection and assembly of data: L Shen; (V) Data analysis and interpretation: Y Wang; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

[#]These authors contributed equally to this work.

Correspondence to: Lei Shen. Department of Gastroenterology, the First Medical Center of People's Liberation Army General Hospital, 28 of Fuxing Road, Haidian District, Beijing 100853, China. Email: kikimymi@163.com.

Background: It is anticipated that the number of elderly patients with gastric cancer (GC) will increase with population aging; however, most studies on GC set the upper age limit at 80 years old, studies on the prognosis of elderly patients with GC over 80 years old is very limited. In this study, we conducted a retrospective analysis of this sub-cohort.

Methods: This retrospective cohort study aimed to analyze the clinical data of patients aged >80 who died of GC in People's Liberation Army General Hospital between 1985 and 2020. We collected clinical informations about pathological GC types, differentiation degrees, clinical stages, anatomic sites and Bormann types of the selected case. Characteristics of participants, such as smoking, drinking, and tumor history, age, gender, and complications, were also recorded. The Kaplan-Meier method, a multivariate Cox multivariate proportional hazard model, and logistic regression were used to analyze the patient overall survival (OS) rates and treatment outcomes.

Results: The study included 92 patients (83.7% men) with a median OS of 45 months. The most common site for GC was the gastric antrum (GA), the most common site of metastatic spread was the liver, and the most common pathological GC type was tubular adenocarcinoma/papillary adenocarcinoma (TAC/PAC). Furthermore, the prevalent complications were hypertension, coronary heart disease, and diabetes. Diabetes was a risk factor affecting the total survival time [hazard ratio (HR) =2.326, P=0.029]. The most often-used GC treatment was curative surgery. The survival time was significantly longer in the curative surgery group and curative surgery + adjuvant chemotherapy group compared with the support care group (HR =0.119, P=0.001; HR =0.110, P=0.001). There was no significant difference in survival time among the palliative chemotherapy group, palliative surgery group, and support care group. Tumor staging was significantly correlated with OS rate, the median survival time of patients at stage III and stage IV GC were significantly lower than the median survival time of patients at stage I GC (HR =6.235, P=0.001; HR =30.955, P=0.001).

Conclusions: For patients over 80 years old with good physical conditions in the early stage of GC, more active treatment can still bring better prognosis.

Keywords: Gastric cancer (GC); elderly; patient; survival analysis; therapy

Submitted Feb 17, 2022. Accepted for publication Apr 18, 2022.
doi: 10.21037/jgo-22-280
View this article at: https://dx.doi.org/10.21037/jgo-22-280

Introduction

Gastric cancer (GC) is the sixth most common cancer in the world and the third most common cause of cancer-related death (1,2). The incidence of GC (~47/100,000) (3) is much higher in China than in any other country (2), making GC the second and the third most common cancer in Chinese men and women, respectively (4). Although there has been a marked decline in incidence and mortality rates of GC worldwide (including China) in the 20th century, China's 2015 cancer statistics (4) showed that population growth and aging have led to a significant ongoing increase in GC cases.

The elderly experience GC more than any other age group. The US Surveillance, Epidemiology, and End Results (SEER) program cancer registry, epidemiology, and relevant study showed that 65.5% of patients with GC were aged >65 at the time of diagnosis. The median age of patients at diagnosis was 71 years, and the median age of GC-induced death was 74 years (5). However, there is a lack of established guidelines for the treatment of GC in elderly patients, which further leads to the underrepresentation of elderly patients in clinical studies. Between 1997 and 2000, 61% of new cancer cases were elderly people (6), but only 32% of participants in phase II and III trials sponsored by the National Cancer Institute were elderly patients. Due to a lack of prospective studies involving elderly patients, many clinicians treat them according to guidelines established for the general population, which may be dangerous for those with several comorbidities.

The incidences of stage IV GC and GC in men are higher in elderly patients than in the younger population. However, there are fewer cases of diffuse-type GC, poorly differentiated (PD) GC [especially signet ring cell carcinoma (SRCC)], Bormann IV, and peritoneal metastasis in older patients than in younger patients. Moreover, a large number of elderly patients opt for partial resection, despite the associated poor prognosis (7). Regarding GC, distal third cancers and highly/moderately differentiated (MD) cancers have been more commonly diagnosed in elderly patients than in young patients (8), and elderly patients are more likely to develop comorbidities (72% in male patients aged >80) than their younger counterparts (9). The physiological reserves of the endocrine, immune, respiratory, cardiovascular, and renal systems, along with other organ systems, are gradually reduced, which increases the difficulties experienced by elderly patients when facing stress events (10). In elderly patients, GC may not affect life expectancy, due to them having already reached old age. Therefore, it is important to adopt appropriate treatment strategies according to the age of GC patients. However, most trials conducted on elderly patients have predominantly enrolled patients aged 65–75 years, or only treated patients aged >75 years old as a sub-cohort. As a result, patients aged >80 are often excluded from GC studies, resulting in a lack of data concerning this sub-cohort. An analysis of sub-cohort data from prospective randomized trials conducted in western countries showed that older patients who underwent radical gastrectomy had lower survival rates than younger patients. A Medical Research Council study compared limited lymph-node dissection (D1) with extended lymph-node dissection (D2) and found a 5-year survival rate in patients aged >60, which was significantly lower than that in patients aged <60 (11). In an Italian trial, patients aged ≥70 had a lower survival rate, regardless of the resection type (D1 or D2). These results show that the survival rate of patients aged >70 is lower than that of patients aged <70 (12). Most randomized studies exclude patients aged 80–85, and studies that evaluate surgical outcomes in elderly patients with GC typically select patients aged <70. A Japanese retrospective study analyzed the data of 272 patients aged ≥80, and the patients who underwent gastrectomy showed better survival than those in the best supportive care group. However, such survival benefit was not observed in the subgroup of ≥90 years old and those with a performance status of 3 (13).

Studies on the survival and prognostic factors of GC in the oldest-old are limited. In Pisanu *et al.*'s study (14), Elderly patients can benefit from surgery as young people. Age is not a contraindication for GC surgery. However, the sample size of the study is very limited, only 23 elderly people over 75 years old were included, and the treatment method is limited to surgery. In Xu *et al.*'s study (15), clinicopathological features and prognosis in elderly GC patients were evaluated, no analysis of the prognosis of multiple treatment options in the elderly either. Relationship between different treatment schemes and prognosis in elderly patients with GC is still rare. More clinical studies on elderly patients, especially those aged >80, with GC are urgently needed. For this reason, we conducted this retrospective study of patients with GC aged >80. Survival analysis was performed based on pathological type, clinical staging, lesion location, and treatment options. The study incorporated relevant cases from 1985 to 2020 to evaluate the treatment and prognosis of elderly patients with GC. We aimed to investigate factors influencing the survival outcomes of patients with GC aged >80 and provide a clinical basis for the evaluation and treatment of these patients. We present the following article in accordance with the STROBE

Table 1 Univariate Kaplan-Meier analysis

Variables	Log-rank (Mantel-Cox)	
	χ^2	P value
Gender	0.721	0.396
Pathology	2.078	0.556
Types of lesions	1.864	0.601
Differentiation	11.133	0.004
Site	0.031	0.985
Smoking history	1.187	0.276
Drinking history	0.006	0.938
Previous tumor history	0.189	0.664
Size	37.526	0.015
Stage	72.007	0.001
Treatment method	64.672	0.001
Hypertension	1.428	0.232
Diabetes	5.328	0.021
Coronary heart disease	1.561	0.212
Arrhythmia	9.615	0.002
Pulmonary disease	3.018	0.082
Cerebral infarction	2.577	0.108

reporting checklist (available at https://jgo.amegroups.com/article/view/10.21037/jgo-22-280/rc).

Methods

Participants

This study is a retrospective cohort study. The study was approved by the Medical Ethics Committee of the People's Liberation Army General Hospital (No. S2020-447-01). The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Individual consent for this retrospective analysis was waived. Using the Electronic Medical Record search engine, the medical records of patients aged >80 who were diagnosed with and died from GC between 1985 and 2020 were retrospectively collected. Patients who did not have pathologically confirmed GC were excluded from the study. The GC staging was determined in accordance with the American Joint Committee on Cancer/Union for International Cancer Control staging system [tumor-node-metastasis (TNM) staging system, 8th edition] (16).

Information, including pathological GC types [early carcinoma (ECA), tubular adenocarcinoma (TAC)/papillary carcinoma, mucinous adenocarcinoma (MAC), and SRCC], differentiation degrees (high, moderate, and low differentiation), clinical stages (stage I, II, III, and IV), anatomic sites [antrum, gastric body (GB), and cardia fundus], Bormann types (I, II, III, and IV), was collected, and case data were consulted. Clinical characteristics, such as smoking, drinking, and tumor history, age, gender, and complications, were also recorded.

Statistical analysis

The Statistical Analysis System (SAS) 9.4 (SAS Institute Inc., Cary, NC, USA) and GraphPad prism 8.0 (GraphPad Software, La Jolla, CA, USA) were used to analyze and map the data, and frequency (%) was used to describe enumeration data. Moreover, the mean, median, and standard deviations were used to describe measurement data. In the overall survival (OS) rate evaluation, the univariate Kaplan-Meier method was used first, after which, the log-rank test was used to draw the survival curve. Variables in the univariate test with a P value of <0.05 were subsequently used in the multivariate Cox regression model. The appropriate reference layer for multiple variable classifications was selected, and a multivariate Cox regression model was built with the hazard ratio (HR) value as the risk assessment parameter, and two-tailed test was used. A P value <0.05 was considered statistically significant.

Results

Patient cohort

A total of 92 patients with GC from 1985 to 2020 were included in this study. All cases died aged >80, had a relatively complete set of clinical data, and were pathologically (histopathology) diagnosed with GC. The cases comprised 77 men (83.7%) and 15 women (16.3%). The OS rate of the patients in the study cohort was 45 months.

Univariate analysis showed that gender, along with smoking and drinking history, had no significant effect on patient survival. In the study cohort, most elderly patients experienced circulatory and respiratory complications. Furthermore, 10 cases had other tumors and only 10 cases did not have a history of tumor complications. The most common complications were hypertension, coronary heart disease, and diabetes (*Table 1*). Diabetes was a risk factor

Table 2 Multivariate analysis of the potential risk factors for death

Characteristics	Variables in the equation						
	β	SE	Wald χ^2	P	HR	95% CI	
						Lower	Upper
Size	−0.111	0.247	0.203	0.653	0.895	0.552	1.451
Differentiation							
MD (*vs.* PD)	0.151	0.535	0.080	0.777	1.163	0.407	3.321
WD (*vs.* PD)	−1.076	0.843	1.630	0.202	0.341	0.065	1.779
Stage							
II (*vs.* I)	0.728	0.459	2.510	0.113	2.070	0.841	5.094
III (*vs.* I)	1.830	0.425	18.514	0.001*	6.235	2.709	14.353
IV (*vs.* I)	3.433	0.480	51.126	0.001*	30.955	12.081	79.316
Treatment							
PCT (*vs.* SC)	−0.326	0.375	0.755	0.385	0.722	0.346	1.506
S (*vs.* SC)	−2.127	0.331	41.334	0.001*	0.119	0.062	0.228
S + ACT (*vs.* SC)	−2.210	0.391	31.953	0.001*	0.110	0.051	0.236
PS (*vs.* SC)	−.579	0.446	1.687	0.194	0.560	0.234	1.343
Diabetes (*vs.* no)	0.844	0.387	4.760	0.029*	2.326	1.090	4.966

*, P<0.05. SE, standard error; HR, hazard ratio; CI, confidence interval; MD, moderately differentiated; PD, poorly differentiated; WD, well differentiated; PCT, palliative chemotherapy; SC, support care; S, curative surgery; S + ACT, curative surgery and adjuvant chemotherapy; PS, palliative surgery.

affecting the total survival time (HR =2.326, P=0.029; *Table 2*). Tumor history and different complications had no significant effects on patient OS rates. At the time of diagnosis, 63% of cases had an Eastern Cooperative Oncology Group performance status (ECOG-PS) score of 1. The most common site of GC was the gastric antrum (GA), the most common pathological GC type was TAC/papillary adenocarcinoma (PAC), and the most common site of metastatic spread was the liver. Additional case characteristics are shown in *Table 3*.

Patient survival and primary tumor characteristics

In the univariate cohort analysis, the primary site (*Figure 1A*, *Table 4*), pathological type (*Figure 1B*, *Table 4*), Borrmann type (*Figure 1C*, *Table 4*), and tumor size (*Table 2*) did not have a significant influence on the patient OS rate (P>0.05). Patients at early stage had a relatively long median survival time of 89.9 months (*Figure 1B*, *Table 4*), whereas patients with TAC/PAC, mucinous carcinoma, and SRCC had median survival times of 16.8, 11.8, and 15.9 months, respectively. However, there was no significant difference among groups with different pathological GC types (P>0.05; *Figure 1B*, *Table 4*). In the univariate analysis, the differentiation degree had a significant effect on survival time (P=0.04; *Figure 1D*, *Table 4*), and in the multivariate analysis, the differentiation degree did not have a significant effect on survival outcomes (P=0.777, P=0.202; *Table 2*).

Treatment and survival

The most common GC treatment among the patients was curative surgery, which was performed on 39 patients (42.4%). Furthermore, 21 patients (22.8%) only received support care after diagnosis, 14 (15.2%) underwent curative surgery and adjuvant chemotherapy, 11 (12.0%) underwent palliative chemotherapy, and 7 (7.6%) underwent palliative surgery. Their median survival times were 50.3, 2.7, 92.5, 7.1, and 14.7 months, respectively. A univariate analysis showed that treatment methods were correlated with the patient OS rate, and another multivariate analysis showed that the OS rates in the curative surgery group and the

Table 3 Baseline characteristics of the participants

Patient characteristics	N=92
Age (years), range (mean ± SD)	80–95 (84.000±3.219)
Gender, n (%)	
Male	77 (83.7)
Female	15 (16.3)
Smoking, n (%)	
Yes	21 (22.8)
No	71 (77.2)
Alcohol, n (%)	
Yes	12 (13.0)
No	80 (87.0)
Comorbidity[1], n (%)	
Hypertension	49 (53.3)
Coronary heart disease	36 (39.1)
Diabetes	31 (33.7)
Lung	14 (15.2)
Cerebrovascular accident	14 (15.2)
Arrhythmia	9 (9.8)
Chronic renal insufficiency	5 (5.4)
Any prior tumor	10 (10.9)
No	22 (23.9)
ECOG-PS, n (%)	
0	0
1	58 (63.0)
2	25 (27.2)
3	9 (9.8)
Metastatic site[1], n (%)	
Liver	13 (14.1)
Peritoneum	7–12
Distant lymph node	11 (12.0)
Lung	3 (3.3)
Others	3 (3.3)

[1], the number of metastatic site and comorbidity exceeds that of the participants, due to patients with multiple metastases and comorbidities. ECOG-PS, Eastern Cooperative Oncology Group performance status.

curative surgery + adjuvant chemotherapy group were significantly higher than that in the support care group (HR =0.119, P=0.001; HR =0.110, P=0.001). There was no significant difference in OS rates between the palliative chemotherapy group and the palliative surgery group (P>0.05; *Figure 1E*, *Table 4*).

Stage and survival

Of the 92 elderly patients, 24 cases (26.1%) did not undergo staging evaluation and 23 cases (25%) were classified as stage IV GC at the time of diagnosis. The median survival times of patients with stage I, II, III, and IV GC were 114.7, 66.0, 32.2, and 4.6 months, respectively. In the univariate analysis, the GC stage and the OS rates were significantly correlated (P=0.001). Further multivariate analysis showed that the median survival time of patients at stage III and stage IV GC were significantly lower than the median survival time of patients at stage I GC (HR =6.235, P=0.001; HR =30.955, P=0.001). The median survival time of patients at stage II GC was longer than the median survival time of those with stage I GC; however, the difference was not statistically significant (P=0.113; *Figure 1F*, *Table 4*).

Discussion

Occurring primarily in the elderly, GC is an age-related disease with a common age at onset of 70 years old (17). The participants of this study were all patients aged >80 in order to investigate the prognosis of the elderly sub-cohort. The ratio of men in the present study was 83.7%, which was significantly higher than the 1:1 male-female ratio (18) among young people. This was in keeping with previous reports (8) that a high portion of elderly GC patients were men. As mentioned earlier, the most common tumor site in this study was the GA, and the most common site of metastatic spread was the liver. Another finding was the presence of stage IV tumors, often accompanied by metastases, in 25% of cases. Furthermore, 22.8% of patients received support care, and the patients who relinquished treatment had stage IV GC. Most patients with stage II or III GC received surgical treatment. There was a failure to diagnose elderly patients with GC at an early stage due to atypical, less obvious symptoms. Tumor staging affected if and how surgery should be performed and was closely

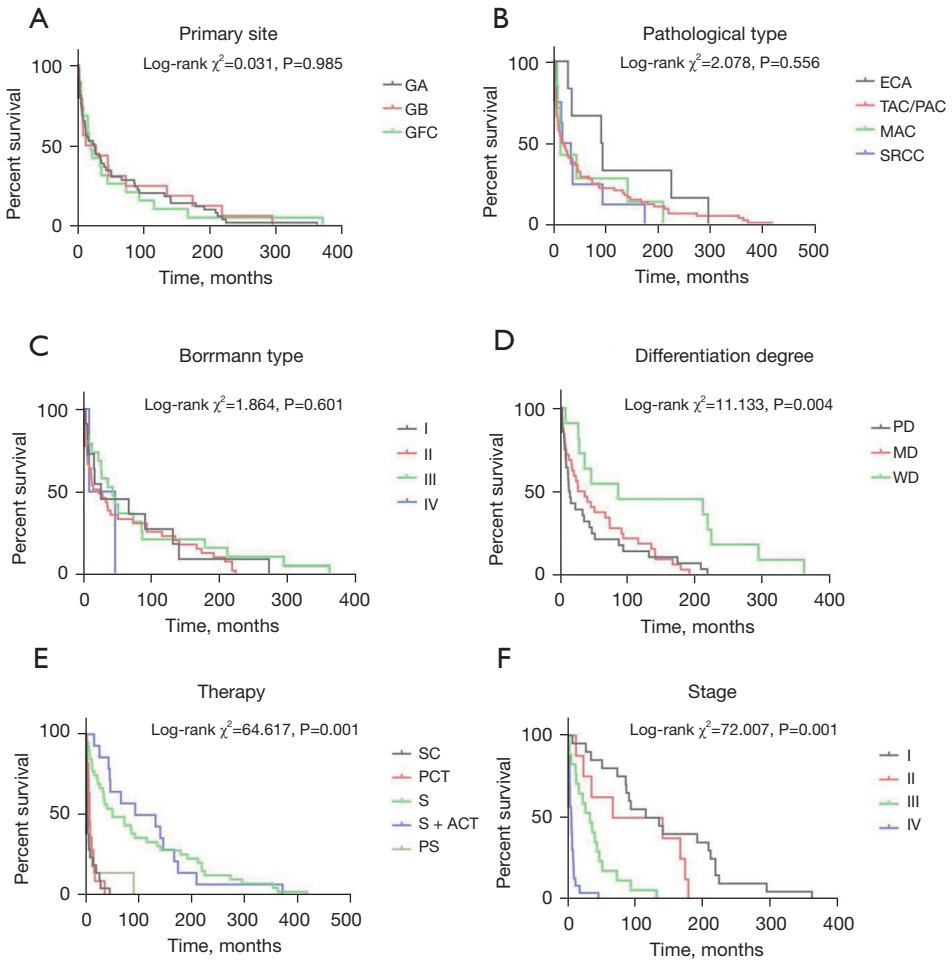

Figure 1 Primary tumor characteristics and survival. (A) Effects of GC primary site on survival outcomes. (B) Effects of GC pathological type on survival outcomes. (C) Effects of GC Borrmann type on survival outcomes. (D) Effects of the differentiation degree on survival outcomes. (E) Effects of therapy on survival outcomes. (F) Effects of stage on survival outcomes. GA, gastric antrum; GB, gastric body; GFC, gastric fundus cardiac; ECA, early carcinoma; TAC, tubular adenocarcinoma; PAC, papillary adenocarcinoma; MAC, mucinous adenocarcinoma; SRCC, signet ring cell carcinoma; PD, poorly differentiated; MD, moderately differentiated; WD, well differentiated; SC, support care; PCT, palliative chemotherapy; S, curative surgery; S + ACT, curative surgery and adjuvant chemotherapy; PS, palliative surgery; GC, gastric cancer.

related to patient prognoses. In addition, staging was significantly related to the survival rate outcomes in the present study.

The results of the present study showed that elderly patients with GC aged >80 can benefit from gastrectomy, despite their complications and generally low ECOG-PS scores. Patients in the curative surgery and curative surgery + adjuvant chemotherapy groups had significantly longer median survival times than those in the support care group. This suggests that seeking treatment was pertinent, especially for older patients in the curative surgery group. This is consistent with a study conducted by Park *et al.* (19), which analyzed the data of patients with GC aged >80 who underwent surgery and found that the 3- and 5-year survival rates were significantly higher in the radical resection group than in the non-resection group. A study by Choo *et al.* (20) also showed that, in patients with advanced GC aged 80–85, a better prognosis can be reached through surgical resection. However, the risks and benefits of surgery should be deliberated with patients aged >86. It is possible that the differences in survival times are due to reasons other than treatment differences, such as perioperative care and

Table 4 Number of patients in different subgroups

Characteristics	Number (ratio)
Primary site, n	
GA	49
GB	16
GFC	19
Not mentioned	8
Pathology type, n (%)	
TAC/PAC	71 (77.2)
SRCC	8 (8.7)
MAC	7 (7.6)
ECA	6 (6.5)
Borrmann type, n	
I	11
II	39
III	19
IV	2
Unknown	21
Differentiation grade, n (%)	
WD	11 (12.0)
MD	33 (35.9)
PD	28 (30.4)
Therapy, n (%)	
SC	21 (22.8)
PCT	11 (12.0)
S	39 (42.4)
S + ACT	14 (15.2)
PS	7 (7.6)
Stage, n (%)	
Stage I	20 (21.7)
Stage II	8 (8.7)
Stage III	17 (18.5)
Stage IV	23 (25.0)
Unknown	24 (26.1)

GA, gastric antrum; GB, gastric body; GFC, gastric fundus cardiac; TAC/PAC, tubular adenocarcinoma/papillary adenocarcinoma; SRCC, signet ring cell carcinoma; MAC, mucinous adenocarcinoma; ECA, early carcinoma; WD, well differentiated; MD, moderately differentiated; PD, poorly differentiated; SC, support care; PCT, palliative chemotherapy; S, curative surgery; S + ACT, curative surgery and adjuvant chemotherapy; PS, palliative surgery.

patient compliance. Patients were screened before surgery in correlation with their prognosis, and the background factors of comorbidity, poor physical condition, and lower ECOG-PS scores were more common in the support care group than in the curative surgery group. Therefore, the observation group cannot be considered a control group in relation to the curative surgery group. However, a multivariate analysis showed that the choice of treatment was an independent prognostic factor.

Previous study (21) has suggested that certain elderly patients who have undergone gastric adenocarcinoma removal may not be able to benefit from adjuvant chemoradiotherapy. In the present study, the survival time of the adjuvant chemotherapy group was significantly higher than of the support care group. However, it is still unclear whether elderly patients can benefit from adjuvant chemotherapy, as a controlled study based on adjuvant chemotherapy after surgical resection was not conducted.

It has been shown that adjuvant chemotherapy could improve survival time in patients with advanced GC. In our study, however, palliative chemotherapy and palliative surgery had no significant effects on the survival outcomes of patients aged >80. Most oncologists in Taiwan do not recommend chemotherapy for patients aged >80, and study (22) has shown a significant decrease in the use of adjuvant chemotherapy among these patients. These results may be associated with higher treatment-related toxicity in older patients. A study on the efficacy and safety of chemotherapy for patients with GC aged >70 showed that chemotherapy could prolong their survival time. However, there is also a higher incidence of hematologic toxicity in these patients than in younger patients (23).

Platinum chemotherapeutics are irreversibly bound with plasma proteins, and free platinum is mainly eliminated by the kidneys. Thus, the plasma levels of platinum depend on the patient's renal function. The association between age and platinum-based chemotherapeutic pharmacokinetics has not been established; however, it is known that renal function declines with age. With the decrease of the creatinine clearance rate, the peak concentration of platinum chemotherapeutics in plasma increases significantly (24). Certain patients in this study also had poor data quality and their adherence to chemotherapy was unknown. According to a Korean study (25), chemotherapy and complications, such as hemorrhage and fractures, resulted in a decrease in ECOG-PS scores, leading to an increased chemotherapy termination rate. A study by Wakahara *et al.* (26) showed that the OS rate in patients with stage II and III GC who

received adjuvant chemotherapy for more than 3 months was increased compared to those who received chemotherapy for less than 3 months. A study by Trumper *et al.* (27) showed that systematic chemotherapy yielded the same benefits in patients aged >70 and those aged <70. However, the study did not include patients aged >80, and patients aged >70 received lower doses of chemotherapy than patients aged <70. Thus, these results did not show that the toxicity of chemotherapeutics did not increase with patient age. Based on the information discussed above, there is a high probability of older patients having cancer, but choosing the appropriate chemotherapy regimen for them may prove difficult.

In this study, most elderly patients were already at the advanced-stage GC when they were diagnosed. As some elderly patients cannot tolerate surgery, many of them either choose palliative surgery or relinquish treatment. At present, there is little evidence that palliative surgery is effective in the treatment of GC. The compliance of elderly patients in the perioperative period and, especially, the postoperative period, was lower than that of young patients (28). Previous study (29) has shown an increase in morbidity and mortality as well as length of hospital stay in elderly patients undergoing surgical resection due to functional reserves and reduced complications. Our results did not reveal that palliative surgery prolonged survival time in older patients, which is consistent with the results of a study by Fujitani *et al.* (30) Although the patients enrolled in the trial by Fujitani *et al.* were aged 49–67, they cannot adequately represent elderly patients. Based on the findings of this study, it can be concluded that palliative gastrectomy or metastatic gastrectomy should not be performed in patients with advanced GC.

Elderly patients are more likely to develop comorbidity than younger patients, and for some patients, traditional chemotherapy may be harmful rather than beneficial (31). The present study found that, among comorbidities, diabetes can significantly affect the patient survival outcome. This is supported by the results of a study by Zheng *et al.* (32), where the prognoses of gastric adenocarcinoma patients with diabetes were worse than the prognoses of patients without diabetes. A slight association between diabetes and GC was found in a meta-analysis of diabetes and GC morbidity and mortality (33), wherein there was also an increase in mortality in patients with both GC and diabetes. However, a survival analysis of 8,423 patients by Dulskas *et al.* (34) showed that there was no difference in GC-specific survival times between the non-diabetic and the diabetic groups. This study retrospectively evaluated the treatment outcomes in patients with GC aged ≥80. However, the small sample size is a limitation of the present study. As the present study was conducted retrospectively, the absence of certain indicators may have affected the results. Several important clinicopathologic features, including socioeconomic and ethnic background, *Helicobacter pylori* infection, genetic background, and histological type according to Lauren's histological classification, have not been discussed. In future studies, a larger amount of information will be collected to improve conclusion accuracy. To minimize bias, data of deceased patients was selected for the present study. The most common site of the primary lesion in these patients was the GA. Most elderly patients had advanced-stage GC and were more likely to have liver metastases than younger patients. These manifestations were similar to the typical symptoms of elderly patients with colorectal cancer (8).

Our results indicated that TAC/PAC is the most common histological type of GC in patients aged ≥80. Patients with stage IV GC have a shorter survival time, and curative surgery and adjuvant chemotherapy are important treatments for GC in elderly patients. Therefore, the treatment of GC in patients aged ≥80 requires individualized evaluation. It is necessary that patients seek further treatment, as old age does not justify withdrawal from treatment. The overall physical condition of elderly patients should be evaluated and an appropriate treatment plan chosen according to the individual results.

Acknowledgments

Funding: None.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://jgo.amegroups.com/article/view/10.21037/jgo-22-280/rc

Data Sharing Statement: Available at https://jgo.amegroups.com/article/view/10.21037/jgo-22-280/dss

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jgo.amegroups.com/article/view/10.21037/jgo-22-280/coif). 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. The study was approved by the Medical Ethics Committee of the People's Liberation Army General Hospital (No. S2020-447-01). The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Individual consent for this retrospective analysis was waived.

References

1. Global Burden of Disease Cancer Collaboration; Fitzmaurice C, Abate D, et al. Global, Regional, and National Cancer Incidence, Mortality, Years of Life Lost, Years Lived With Disability, and Disability-Adjusted Life-Years for 29 Cancer Groups, 1990 to 2017: A Systematic Analysis for the Global Burden of Disease Study. JAMA Oncol 2019;5:1749-68.
2. Ajani JA, D'Amico TA, Almhanna K, et al. Gastric Cancer, Version 3.2016, NCCN Clinical Practice Guidelines in Oncology. J Natl Compr Canc Netw 2016;14:1286-312.
3. Zhou M, Wang H, Zeng X, et al. Mortality, morbidity, and risk factors in China and its provinces, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet 2019;394:1145-58.
4. Chen W, Zheng R, Baade PD, et al. Cancer statistics in China, 2015. CA Cancer J Clin 2016;66:115-32.
5. Gloeckler Ries LA, Reichman ME, Lewis DR, et al. Cancer survival and incidence from the Surveillance, Epidemiology, and End Results (SEER) program. Oncologist 2003;8:541-52.
6. Lewis JH, Kilgore ML, Goldman DP, et al. Participation of patients 65 years of age or older in cancer clinical trials. J Clin Oncol 2003;21:1383-9.
7. Kong X, Wang JL, Chen HM, et al. Comparison of the clinicopathological characteristics of young and elderly patients with gastric carcinoma: a meta analysis. J Surg Oncol 2012;106:346-52.
8. Joharatnam-Hogan N, Shiu KK, Khan K. Challenges in the treatment of gastric cancer in the older patient. Cancer Treat Rev 2020;85:101980.
9. van Gestel YR, Lemmens VE, de Hingh IH, et al. Influence of comorbidity and age on 1-, 2-, and 3-month postoperative mortality rates in gastrointestinal cancer patients. Ann Surg Oncol 2013;20:371-80.
10. Clegg A, Young J, Iliffe S, et al. Frailty in elderly people. Lancet 2013;381:752-62.
11. Cuschieri A, Weeden S, Fielding J, et al. Patient survival after D1 and D2 resections for gastric cancer: long-term results of the MRC randomized surgical trial. Surgical Co-operative Group. Br J Cancer 1999;79:1522-30.
12. Degiuli M, Sasako M, Ponti A, et al. Randomized clinical trial comparing survival after D1 or D2 gastrectomy for gastric cancer. Br J Surg 2014;101:23-31.
13. Endo S, Fujiwara Y, Higashida M, et al. Survival analyses of elderly gastric cancer patients with or without surgery. Surg Today 2022;52:75-83.
14. Pisanu A, Montisci A, Piu S, et al. Curative surgery for gastric cancer in the elderly: treatment decisions, surgical morbidity, mortality, prognosis and quality of life. Tumori 2007;93:478-84.
15. Xu G, Feng F, Liu S, et al. Clinicopathological features and prognosis in elderly gastric cancer patients: a retrospective cohort study. Onco Targets Ther 2018;11:1353-62.
16. Brierley JD, Gospodarowicz MK, Wittekind C. TNM classification of malignant tumours. 8th ed. Hoboken: John Wiley & Sons, 2017.
17. Jung KW, Won YJ, Kong HJ, et al. Cancer statistics in Korea: incidence, mortality, survival, and prevalence in 2011. Cancer Res Treat 2014;46:109-23.
18. Medina-Franco H, Heslin MJ, Cortes-Gonzalez R. Clinicopathological characteristics of gastric carcinoma in young and elderly patients: a comparative study. Ann Surg Oncol 2000;7:515-9.
19. Park HJ, Ahn JY, Jung HY, et al. Clinical Characteristics and Outcomes of Gastric Cancer Patients Aged over 80 Years: A Retrospective Case-Control Study. PLoS One 2016;11:e0167615.
20. Choo JW, Ju Y, Lim H, et al. Is it beneficial to perform surgical resection in elderly patients more than 80 years old with advanced gastric cancer? Scand J Gastroenterol 2017;52:1057-64.
21. Hoffman KE, Neville BA, Mamon HJ, et al. Adjuvant

therapy for elderly patients with resected gastric adenocarcinoma: population-based practices and treatment effectiveness. Cancer 2012;118:248-57.
22. Wong JU, Tai FC, Huang CC. An examination of surgical and survival outcomes in the elderly (65-79 years of age) and the very elderly (≥80 years of age) who received surgery for gastric cancer. Curr Med Res Opin 2020;36:229-33.
23. Tsushima T, Hironaka S, Boku N, et al. Comparison of safety and efficacy of S-1 monotherapy and S-1 plus cisplatin therapy in elderly patients with advanced gastric cancer. Int J Clin Oncol 2013;18:10-6.
24. Crombag MR, Joerger M, Thürlimann B, et al. Pharmacokinetics of Selected Anticancer Drugs in Elderly Cancer Patients: Focus on Breast Cancer. Cancers (Basel) 2016;8:6.
25. Thanikachalam K, Khan G. Colorectal Cancer and Nutrition. Nutrients 2019;11:164.
26. Wakahara T, Ueno N, Maeda T, et al. Impact of Gastric Cancer Surgery in Elderly Patients. Oncology 2018;94:79-84.
27. Trumper M, Ross PJ, Cunningham D, et al. Efficacy and tolerability of chemotherapy in elderly patients with advanced oesophago-gastric cancer: A pooled analysis of three clinical trials. Eur J Cancer 2006;42:827-34.
28. Slagter AE, Tudela B, van Amelsfoort RM, et al. Older versus younger adults with gastric cancer receiving perioperative treatment: Results from the CRITICS trial. Eur J Cancer 2020;130:146-54.
29. Wu CW, Lo SS, Shen KH, et al. Surgical mortality, survival, and quality of life after resection for gastric cancer in the elderly. World J Surg 2000;24:465-72.
30. Fujitani K, Yang HK, Mizusawa J, et al. Gastrectomy plus chemotherapy versus chemotherapy alone for advanced gastric cancer with a single non-curable factor (REGATTA): a phase 3, randomised controlled trial. Lancet Oncol 2016;17:309-18.
31. Matsunaga T, Ishiguro R, Miyauchi W, et al. Appraisal of long-time outcomes after curative surgery in elderly patients with gastric cancer: a propensity score matching analysis. BMC Surg 2021;21:33.
32. Zheng J, Xie SH, Santoni G, et al. Population-based cohort study of diabetes mellitus and mortality in gastric adenocarcinoma. Br J Surg 2018;105:1799-806.
33. Tian T, Zhang LQ, Ma XH, et al. Diabetes mellitus and incidence and mortality of gastric cancer: a meta-analysis. Exp Clin Endocrinol Diabetes 2012;120:217-23.
34. Dulskas A, Patasius A, Linkeviciute-Ulinskiene D, et al. A cohort study of antihyperglycemic medication exposure and survival in patients with gastric cancer. Aging (Albany NY) 2019;11:7197-205.

(English Language Editor: J. Jones)

Cite this article as: Shen L, Zhang X, Kong L, Wang Y. The clinical features, management, and survival of elderly patients with gastric cancer. J Gastrointest Oncol 2022;13(2):605-614. doi: 10.21037/jgo-22-280

