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Are the elderly patient's changes in the health-related quality of life one year after gastrectomy for stomach cancer different from those in young patients?

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Purpose: Gastrectomy for elderly patients can significantly deteriorate the health-related quality of life (HRQoL). There was no report comparing HRQoL of elderly patients with young patients after gastrectomy for gastric cancer. This study assessed the differences in the changes of HRQoL at one year after gastrectomy according to age.
Methods: From May 2014 to Feb 2016, we prospectively enrolled patients undergoing gastrectomy for gastric cancer. They completed the European Organization for Research and Treatment of Cancer and gastric questionnaires preoperatively and at postoperative 1, 3, 6, 9, and 12 months.
Results: We included 57 elderly patients (≥70 years old) and 74 younger patients. The elderly had similar demographic, surgical, and pathological characteristics with young patients except that elderly had more comorbidity, laparoscopic gastrectomies, and lesser postoperative chemotherapy. One month after gastrectomy, the score of global health status/quality of life, physical, role, and social functioning were significantly impaired in elderly patients. Among them, physical and role functioning were more impaired than those of young patients. The scores of physical functioning, role functioning, cognitive functioning, and social functioning were not fully recovered till 1 year after surgery. There was a significant age group difference in the changes in physical function over the 1-year follow-up.
Conclusion: Elderly patients' global health status/quality of life and social functioning significantly decreased at postoperative 1 month and recovered by 6 months after gastrectomy. There was a significant age-specific difference in physical functioning throughout the 1-year follow-up. Surgeons need to pay more attention to recovery of the elderly patients' HRQoL after gastrectomy.
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Key Words: Elderly patients, Gastrectomy, Gastric cancer, Quality of life

INTRODUCTION

The number of elderly patients who underwent gastrectomy increased recently. This trend will be continued because life expectancy has been improved and the proportion of elderly patients is predicted to grow. In Korea, the proportion of elderly patients aged more than 70 years was continuously increased from 9.1% in 1995 to 25.3% in 2014 according to the Information Committee of the Korean Gastric Cancer Association [1]. The Surveillance, Epidemiology, and End Results (SEER) database in the United States also shzowed that elderly patients aged 80 years and more increased from 11.7% in period 1988–2003 to 13.1% in period 2004–2010 [2].

Although old age currently is not considered as an absolute

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contraindication to surgery for gastric cancer, postoperative morbidity and mortality in elderly patients were usually reported as higher than younger patients [3,4]. Gastrectomy can significantly deteriorate the health-related (HR) quality of life (QoL) [5-8]. As for surgical outcomes, there were many reports about morbidity, mortality, and survival rate. However, there were few studies about HRQoL in elderly patients.

The purposes of this study were to analyze the changes of the HRQoL in elderly patients who were 70 years old or elder according to the periods (preoperative day, postoperative 1, 3, 6, 9, and 12 months) and to compare them with those of young patients.

METHODS

Patients

From May 2014 to February 2016, we prospectively enrolled patients undergoing gastrectomy. They were asked to complete the HRQoL questionnaires preoperatively and at 5 postoperative intervals up to 1 year (postoperative 1, 3, 6, 9, and 12 months). Patients who postoperatively completed at least 2 questionnaires were included and patients with (1) combined resection except for cholecystectomy and splenectomy, (2) previous or combined malignancies, or (3) neurologic or psychological conditions disable to answer the questionnaires were excluded. This study was approved by Institutional Review Board of SMG-SNU Boramae Medical Center (No. 16-2014-127) and the written informed consent was obtained.

Surgery

All patients underwent surgery first according to Korean Practice Guideline for Gastric Cancer if the tumor is outside of the indication for endoscopic resection or and ≥cT1b or cN+ and M0 gastric cancer [9] and upfront surgery is standard treatment for gastric cancer in Korea. Considering the location and clinical stage of tumor and the length of resectional margin, distal gastrectomy/pylorus-preserving gastrectomy or total gastrectomy was done. Reconstruction was performed with Billroth I or II gastrojejunostomy after distal gastrectomy, and Roux-en-Y esophagojejunostomy after total gastrectomy. D1+ lymphadenectomy and D2 lymphadenectomy were performed for early gastric cancer patients and advanced gastric cancer patients, respectively. Laparoscopic gastrectomy was performed if the tumor was not advanced.

After surgery, patients were placed on a diet program that included drinking water on the 3rd postoperative day, followed by a liquid and soft diet. Patients were planned to be discharged on the 7th day, postoperatively.

Health-related quality of life assessment

The HRQoL was assessed using the Korean version of European Organization for Research and Treatment of Cancer (EORTC) Quality of Life Questionnaires (QLQ). It consisted of the general module, the EORTC QLQ-C30, and the gastric cancer-specific module, the EORTC QLQ-STO22 [10-12]. The EORTC QLQ-C30 included 30 questions; a global health status/QoL scale, 5 functional scales (physical, role, emotional, cognitive, and social), and 9 symptoms scales/items (fatigue, nausea and vomiting, pain, dyspnea, insomnia, appetite loss, constipation, diarrhea, and financial difficulties). The EORTC QLQ-STO22 is a supplement to the QLQ-C30 and is including 22 questions evaluating 9 symptom scales/items (dysphasia, chest and abdominal pain, reflux, eating restriction, dry mouth, taste, body image, anxiety, and hair loss).

The preoperative HRQoL assessment was performed when patients were hospitalized for surgery; alternatively, the postoperative HRQoL assessment was performed at the outpatient department. For global QoL and the functional scales, a higher score indicates better HRQoL, with 100 being perfect. For symptom scales, a lower score indicates better HRQoL, with 0 being perfect or no symptoms reported.

Statistics

Demographic and clinical parameters of both age groups (70 years or older *vs.* 69 years or younger) were summarized using mean ± standard deviation for continuous variables and frequency (percentage) for categorical variables. The differences in the continuous variables were compared using 2-sample t-test and/or Wilcoxon rank-sum test and Pearson chi-square tests, and exact binomial tests were used to compare the distributions in categorical variables. Normal quantile-quantile plots were examined for checking normality of HRQoL assessment. For comparison between the age groups at each time point, 2-sample t-test were used. For comparison between adjacent time points, 2-sample t-tests were conducted. To account for within-individual correlations, mixed-effects models were fitted for each of 24 HRQoL outcomes adjusting for age, sex, extent of gastrectomy (partial or whole), minimal invasive gastrectomy (open or laparoscopic gastrectomy), TNM stage, postoperative chemotherapy, time, time^2, and age × time^2, respectively.

To address missing data due to dropouts, we also explored last-observation carried forward approach (LOCF) and the inverse probability weight (IPW) [13]. A 2-sided P-value of <0.05 was considered statistically significant. For statistical analysis, the R program package (R Foundation for Statistical Computing, Vienna, Austria; http://www.r-project.org) and IBM SPSS Statistics ver. 23 (IBM Corp., Armonk, NY, USA) was used.

RESULTS

Patients

All 252 patients were screened and 144 patients were eligible

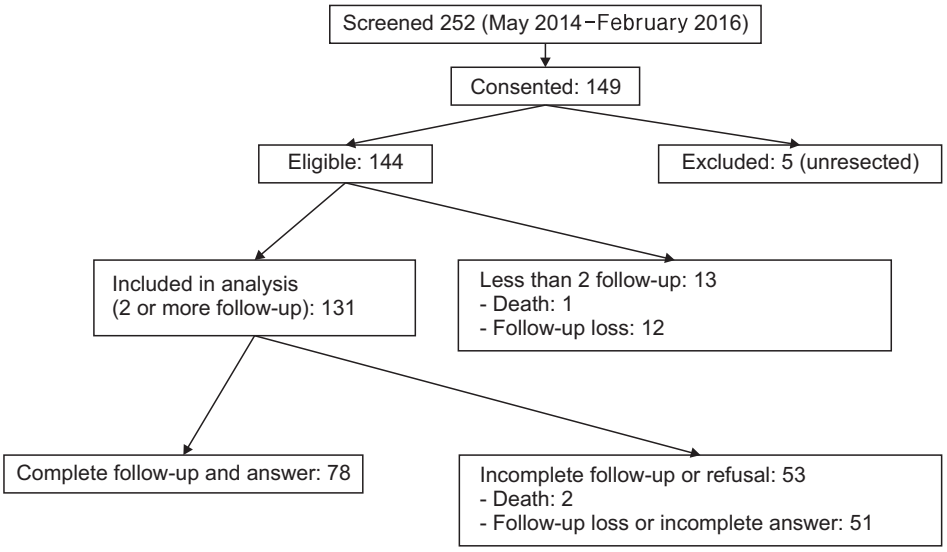

Fig. 1. Patients' registration.

Table 1. Patients' demographic, surgical, and tumor characteristics

Characteristic	Elderly group (n = 57)	Young group (n = 74)	P-value
Age (yr)	75.5 ± 4.4	56.2 ± 9.1	<0.001
Sex			
Male	41 (71.9)	51 (68.9)	0.847
Female	16 (28.1)	23 (31.1)	
Body mass index (kg/m^2)	23.5 ± 3.5	23.5 ± 2.9	0.919
Comorbidity (+)	43 (75.4)	38 (54.4)	0.005
Pulmonary disease	7 (12.3)	1 (1.4)	0.010
Laparoscopy	49 (86.0)	54 (73.0)	0.072
Operation extent			
Distal	46 (80.7)	56 (75.7)	0.492
Total	11 (19.3)	18 (24.3)	
Anastomosis, BI/BII/Roux-enY	11/35/11	27/26/18	0.013
No. of retrieved LN	39.4 ± 15.7	40.5 ± 14.3	0.692
Operation time (min)	172.0 ± 29.7	166.7 ± 38.5	0.623
TNM stage			
T1	37 (64.9)	48 (64.9)	0.526
N0	38 (66.7)	50 (67.6)	0.913
M0	54 (94.7)	73 (98.6)	0.317
TNM stage according to AJCC 7th edition			
I	40 (70.2)	47 (63.5)	0.365
II	6 (10.5)	13 (17.6)	
III	8 (14.0)	13 (17.6)	
IV	3 (5.3)	1 (1.4)	
Hospital stay day	10.2 ± 9.2	8.0 ± 1.9	0.050
Morbidity in 30 day	16 (28.1)	16 (21.6)	0.394
Mortality in 30 day	0 (0)	0 (0)	
Reoperation	0 (0)	0 (0)	
Postoperative chemotherapy	10 (17.5)	24 (32.4)	0.054
Recurrence within 1 yr	5 (8.8)	4 (5.4)	0.502
Death within 1 yr	1 (1.8)	1 (1.4)	0.852

Values are presented as mean ± standard deviation or number (%).
BI, Billroth I; BII, Billroth II; LN, lymph node; AJCC, American Joint Committee on Cancer.

and finally 57 elderly patients (≥70 years old) and 74 younger patients were included (Fig. 1).

Patients' characteristics were summarized in Table 1. The elderly patients had similar demographic, surgical, and pathological characteristics with young patients while the elderly had more comorbidity (P = 0.005), especially pulmonary disease (P = 0.010). The elderly patients tend to have more laparoscopic surgery, Billroth II anastomosis after distal gastrectomy, longer hospital stay, and more frequent postoperative chemotherapy, which were not significantly different from the younger patients. There were also no significant differences in morbidity, mortality, and reoperation, respectively.

Changes of HRQoL 1 year after gastrectomy

Table 2 showed preoperative HRQoL scores of the age groups. Preoperatively, elderly patients had lower score of physical functioning and more symptoms of dyspnea and dysphagia.

Postoperative longitudinal changes of HRQoL were shown in Fig. 2. The elderly patients' scores of global health status/QoL, physical functioning, role functioning, and social functioning were severely deteriorated one month after gastrectomy. The scores of global health status/QoL and emotional functioning were recovered to some degree of preoperative levels but those of physical functioning, role functioning, cognitive functioning, and social functioning were not fully recovered till 1 year after surgery. Pain, appetite loss, and financial difficulties were worsened 1 month after gastrectomy and improved till 1 year after surgery. Fatigue and diarrhea were continuously worsened after gastrectomy. Dysphagia, chest and abdominal pain, eating restriction, and dry mouth showed similar patterns which were worsened 1 month after gastrectomy and improved till 1 year after surgery. But they were not completely recovered.

Predictive factors for HRQoL

Noting that HRQoL could be confounded with demographical (age and sex) and clinical factors (extent of gastrectomy, laparoscopic gastrectomy, TNM stage, and postoperative chemotherapy), multivariable adjusted regression analysis using mixed-effects models were performed for each HRQoL, respectively (Table 3). Considering the age groups, on average over the 1-year follow-up, the elderly group appeared to show

Table 2. Preoperative quality of life

Questionnaire	Elderly group (n = 57)	Young group (n = 74)	P-value
QLQ-C30 global health and function			
Global health status and quality of life	63.2 ± 25.4	61.3 ± 22.5	0.458
Physical functioning	85.0 ± 16.2	90.4 ± 15.6	0.006
Role functioning	87.7 ± 23.5	90.8 ± 22.4	0.191
Emotional functioning	81.7 ± 23.0	77.0 ± 23.1	0.102
Cognitive functioning	90.4 ± 14.1	92.3 ± 15.2	0.249
Social functioning	87.1 ± 23.8	81.5 ± 27.8	0.218
QLQ-C30 symptom			
Fatigue	17.0 ± 18.9	18.8 ± 22.4	0.942
Nausea and vomiting	4.7 ± 11.3	7.2 ± 15.9	0.556
Pain	6.4 ± 18.0	7.9 ± 15.9	0.177
Dyspnea	20.5 ± 32.6	9.9 ± 23.9	0.030
Insomnia	25.2 ± 36.9	18.5 ± 28.2	0.497
Appetite loss	22.8 ± 35.7	14.0 ± 27.6	0.143
Constipation	19.3 ± 32.1	11.0 ± 22.9	0.149
Diarrhea	7.0 ± 23.4	10.4 ± 22.0	0.084
Financial difficulties	25.2 ± 33.5	27.5 ± 34.2	0.684
QLQ-STO22 symptom			
Dysphagia	10.0 ± 12.2	5.6 ± 11.5	0.011
Chest and abdominal pain	7.5 ± 11.5	11.7 ± 17.1	0.221
Reflux symptoms	10.9 ± 16.3	11.7 ± 18.3	0.905
Eating restriction	8.0 ± 13.3	8.3 ± 15.2	0.723
Having a dry mouth	26.9 ± 31.1	22.1 ± 30.4	0.291
Taste	10.5 ± 28.3	6.3 ± 17.2	0.949
Body image	3.5 ± 12.1	7.7 ± 19.5	0.199
Anxiety	36.8 ± 26.4	44.0 ± 22.3	0.073
Hair loss	7.0 ± 15.7	5.2 ± 17.4	0.135

Values are presented as mean ± standard deviation.
Assessed using European Organization for Research and Treatment of Cancer Quality of Life Questionnaires (QLQ).

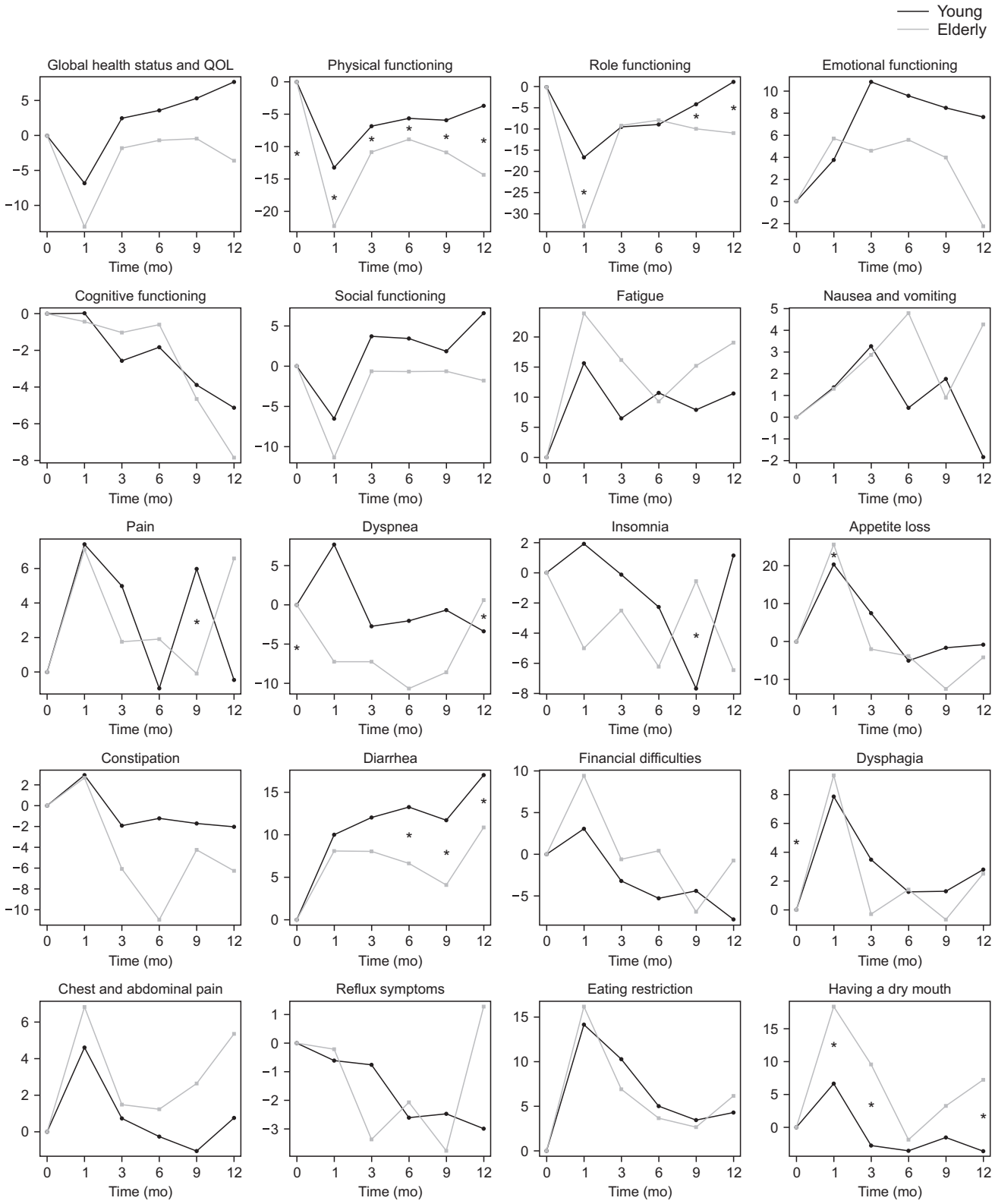

Fig. 2. Periodic changes in health-related quality of life (QoL) scores. *Significant difference between the elderly and young patients ($P < 0.05$).

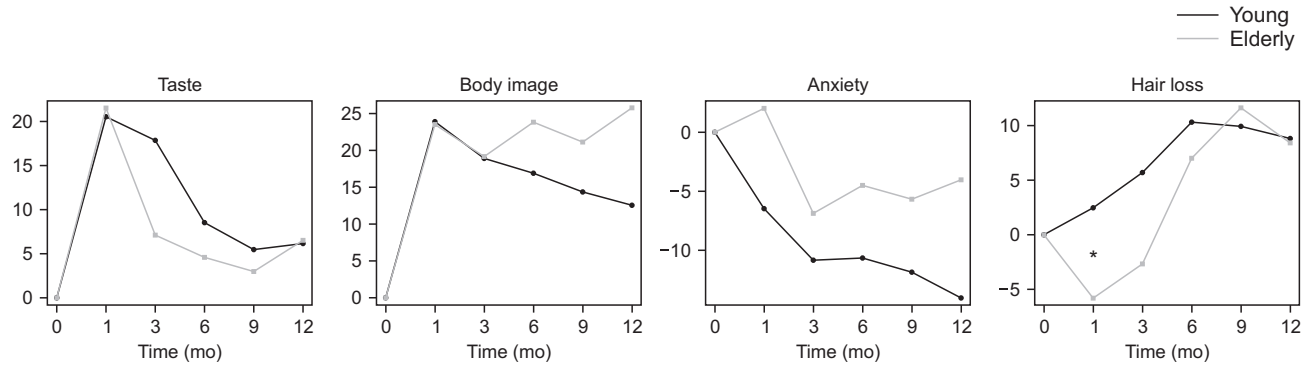

Fig. 2. Continued.

lower scores in physical function compared to the younger group (mean difference [MD], –8.663; 95% confidence interval [CI], –13.702 to –3.623; P = 0.001) (Fig. 2) while there are no statistically significant differences in global health status/QoL (MD, –0.353; 95% CI, –5.886 to 5.181; P = 0.901). Considering the age group and time change together, there was a significant age group difference in the changes in physical function over the 1-year follow-up where the elderly group tends to decrease in their physical function after 9 months (P = 0.035) (Table 3). The score of global health status/QoL shows the similar pattern until the 1st month after surgery; however, there were opposite trends between the 2 groups while this difference did not reach statistical significance (P = 0.066) (Table 3, Fig. 2). Elderly patients had significant appetite loss and dry mouth (P = 0.013 and P = 0.017, respectively).

Meanwhile, total gastrectomy, laparoscopic gastrectomy, postoperative chemotherapy, TNM stage, and sex also significantly affect some scores of HRQoL after gastrectomy (Table 4).

DISCUSSION

Patients after gastrectomy were reported to encounter functional impairments and symptoms, but experience only a slightly impaired global HRQoL [5,8]. HRQoL deteriorations in physical, role, and cognitive functioning scales, and significant reductions lasted till 36-month after total gastrectomy [14]. Persistent QoL deterioration after distal subtotal gastrectomy is primarily due to financial difficulties, eating restrictions, and body image concerns [6].

However, there was no report that compares HRQoL of elderly and young patients after gastrectomy for gastric cancer. This study demonstrated the difference in HRQoL between elderly patients and young patients. Elderly patients' score of global health status/QoL, physical functioning, role functioning, and social functioning were significantly deteriorated at postoperative 1 month. Among them, physical and role functioning were more impaired than those of young patients. Furthermore, the scores of impaired physical functioning, role functioning, cognitive functioning, and social functioning were not restored till postoperative 1 year. This study also demonstrated that there was a significant age group difference in the longitudinal changes in physical function over the 1-year follow-up, but not in global health status/QoL.

Except for age groups, other factors related to HRQoL identified in this study were time trend, sex, total gastrectomy, laparoscopic gastrectomy, and postoperative chemotherapy. Total gastrectomy was known to have more negative effect on HRQoL than distal gastrectomy [5,7,8,14-17], which preserves more stomach and requires a less extensive lymphadenectomy. The lower HRQoL of women was consistent with other studies [5,18]. Laparoscopic distal gastrectomy resulted in significantly better HRQoL scores on global health status/QoL and most functionings [5,7,19] and many randomized controlled trials to support this are ongoing [20-22].

This study has several limitations. First, EORTC QLQ-C30 and QLQ-STO22 tools were not optimized for elderly patients and tended to overestimate the HRQoL of the elderly. For comparison with young patients, using well-established tool like EORTC QLQ was inevitable. Second, a large amount of missing data occurred during the follow-up. Most participants showed up for scheduled visit, but some refused to complete the HRQoL assessments because they felt the QoL questionnaire too burdensome. Twelve patients (8.3%) were excluded owing to incomplete follow-ups and a further 35.4% (51 of 144) were included but had incomplete data. An additional 1.4% of patients died during follow-up. We explored several approaches to account for missing data, including various joint likelihood-factorization techniques for longitudinal studies. For example, we found that result showed similar results when we analyzed our data using the LOCF and IPW approaches (Supplementary Fig. 1) [13]. However, we acknowledge that missing data approaches methods suffered from inherent limitations as we cannot test the performances of each approach in the absence of actual observations. Thus in this study, we excluded missing data points from the analysis and used the completely observed

Table 3. Multivariable adjusted mixed effect model outcomes for 24 health-related quality of life endpoints

Endpoint	Age (elderly/young)		Time		Time^2		Age × time^2	
	Est. (95% CI)	P-value	Est. (95% CI)	P-value	Est. (95% CI)	P-value	Est. (95% CI)	P-value
QLQ-C30 global health and function								
Global health status and quality of life	–0.350 (–5.886 to 5.181)	0.901	1.089 (–0.066 to 2.245)	0.065	–0.021 (–0.121 to 0.079)	0.683	–0.051 (–0.106 to 0.003)	0.066
Physical functioning	–8.663 (–13.702 to –3.623)	0.001*	–0.897 (–1.807 to 0.012)	0.053	0.086 (0.007 to 0.164)	0.033	–0.046 (–0.089 to –0.003)	0.035
Role functioning	–5.943 (–12.365 to 0.479)	0.070	–1.131 (–2.595 to 0.332)	0.130	0.154 (0.028 to 0.281)	0.017	–0.054 (–0.123 to 0.015)	0.123
Emotional functioning	2.668 (–2.874 to 8.21)	0.345	2.462 (1.105 to 3.818)	<0.001*	–0.18 (–0.297 to –0.063)	0.003*	–0.043 (–0.107 to 0.02)	0.183
Cognitive functioning	–1.815 (–5.651 to 2.02)	0.354	–0.185 (–0.983 to 0.613)	0.649	–0.021 (–0.09 to 0.048)	0.551	–0.015 (–0.052 to 0.023)	0.442
Social functioning	2.641 (–3.813 to 9.096)	0.422	0.950 (–0.35 to 2.251)	0.152	–0.035 (–0.148 to 0.077)	0.539	–0.027 (–0.089 to 0.034)	0.381
QLQ-C30 symptom								
Fatigue	3.632 (–2.893 to 10.156)	0.275	1.263 (–0.117 to 2.642)	0.073	–0.078 (–0.198 to 0.041)	0.197	0.015 (–0.05 to 0.08)	0.654
Nausea and vomiting	–1.906 (–5.416 to 1.604)	0.287	0.652 (–0.261 to 1.565)	0.162	–0.067 (–0.146 to 0.012)	0.097	0.027 (–0.016 to 0.07)	0.210
Pain	–3.426 (–8.461 to 1.609)	0.182	–0.098 (–1.175 to 0.979)	0.858	0.001 (–0.092 to 0.094)	0.989	0.025 (–0.026 to 0.076)	0.331
Dyspnea	0.619 (–5.611 to 6.849)	0.846	–1.979 (–3.137 to –0.822)	0.001*	0.132 (0.032 to 0.232)	0.010	0.068 (0.013 to 0.123)	0.015
Insomnia	5.87 (–2.661 to 14.401)	0.177	–1.189 (–2.711 to 0.333)	0.126	0.095 (–0.037 to 0.227)	0.157	–0.020 (–0.092 to 0.052)	0.587
Appetite loss	8.329 (1.73 to 14.928)	0.013	–2.845 (–4.762 to –0.929)	0.004*	0.152 (–0.014 to 0.317)	0.072	–0.039 (–0.129 to 0.051)	0.390
Constipation	6.587 (–0.62 to 13.794)	0.073	–1.427 (–2.949 to 0.095)	0.066	0.103 (–0.028 to 0.234)	0.125	–0.015 (–0.087 to 0.057)	0.686
QLQ-STO22 symptom								
Diarrhea	–4.102 (–9.671 to 1.467)	0.149	1.731 (0.267 to 3.195)	0.020	–0.061 (–0.187 to 0.065)	0.343	–0.049 (–0.118 to 0.02)	0.163
Financial difficulties	–0.355 (–9.473 to 8.763)	0.939	–1.244 (–2.756 to 0.269)	0.107	0.053 (–0.077 to 0.184)	0.425	0.005 (–0.067 to 0.076)	0.899
Dysphagia	3.485 (–0.026 to 6.995)	0.052	–0.551 (–1.391 to 0.289)	0.198	0.039 (–0.034 to 0.111)	0.298	–0.01 (–0.05 to 0.029)	0.614
Chest and abdominal pain	–3.13 (–7.189 to 0.929)	0.131	–0.526 (–1.407 to 0.355)	0.242	0.037 (–0.039 to 0.113)	0.338	0.017 (–0.024 to 0.059)	0.418
Reflux symptoms	–1.305 (–4.866 to 2.257)	0.473	–0.889 (–1.738 to –0.041)	0.040	0.058 (–0.016 to 0.131)	0.123	0.018 (–0.022 to 0.058)	0.372
Eating restriction	–0.794 (–5.008 to 3.42)	0.712	0.243 (–0.727 to 1.213)	0.624	–0.042 (–0.126 to 0.042)	0.328	0 (–0.046 to 0.045)	0.991
Having a dry mouth	10.301 (1.86 to 18.742)	0.017	–1.315 (–2.846 to 0.216)	0.092	0.077 (–0.055 to 0.21)	0.252	–0.007 (–0.08 to 0.065)	0.841
Taste	2.866 (–4.087 to 9.819)	0.419	0.654 (–1.029 to 2.338)	0.446	–0.095 (–0.24 to 0.05)	0.199	0.002 (–0.077 to 0.082)	0.955
Body image	–2.543 (–9.878 to 4.791)	0.497	3.754 (2.134 to 5.375)	<0.001*	–0.299 (–0.438 to –0.159)	<0.001*	0.070 (–0.006 to 0.147)	0.072
Anxiety	–1.992 (–8.542 to 4.558)	0.551	–2.275 (–3.486 to –1.063)	<0.001*	0.122 (0.017 to 0.227)	0.022	0.025 (–0.032 to 0.082)	0.391
Hair loss	–1.579 (–7.122 to 3.963)	0.577	2.082 (0.875 to 3.288)	0.001*	–0.116 (–0.22 to –0.012)	0.030	0.040 (–0.017 to 0.097)	0.166

Assessed using European Organization for Research and Treatment of Cancer Quality of Life Questionnaires (QLQ).
EST., estimate; CI, confidence interval.
*Significant difference ($P < 0.05$).

Table 4. Parameter estimates for 24 health-related quality of life outcomes except age and time

Endpoint	Male sex		Postop chemotherapy		Distal/total		Open/laparoscopic		TNM stage	
	Est. (95% CI)	P-value	Est. (95% CI)	P-value	Est. (95% CI)	P-value	Est. (95% CI)	P-value	Est. (95% CI)	P-value
QLQ-C30 global health and function										
Global health status and quality of life	3.292 (–2.187 to 8.771)	0.239	–3.001 (–12.617 to 6.616)	0.541	1.113 (–5.193 to 7.420)	0.729	–3.580 (–12.241 to 5.082)	0.418	–5.193 (–9.893 to –0.494)	0.030
Physical functioning	2.550 (–2.558 to 7.659)	0.328	–2.301 (–11.241 to 6.638)	0.614	2.938 (–2.937 to 8.813)	0.327	–0.071 (–8.132 to 7.989)	0.986	–4.039 (–8.380 to 0.302)	0.068
Role functioning	2.965 (–3.278 to 9.208)	0.352	–6.919 (–17.901 to 4.063)	0.217	2.092 (–5.097 to 9.281)	0.568	–0.027 (–9.909 to 9.854)	0.996	–8.739 (–14.132 to –3.346)	0.001*
Emotional functioning	9.427 (4.139 to 14.715)	<0.001*	11.471 (2.146 to 20.795)	0.016	–5.355 (–11.448 to 0.739)	0.085	–10.349 (–18.730 to –1.969)	0.016	0.704 (–3.898 to 5.305)	0.764
Cognitive functioning	3.416 (–0.385 to 7.216)	0.078	3.470 (–3.200 to 10.140)	0.308	3.026 (–1.349 to 7.400)	0.175	0.186 (–5.821 to 6.194)	0.952	1.613 (–1.646 to 4.872)	0.332
Social functioning	–0.111 (–6.544 to 6.322)	0.973	5.647 (–5.633 to 16.927)	0.327	1.887 (–5.521 to 9.295)	0.618	–4.127 (–14.292 to 6.037)	0.426	–4.085 (–9.587 to 1.418)	0.146
QLQ-C30 symptom										
Fatigue	–1.643 (–8.09 to 4.804)	0.618	–7.823 (–19.150 to 3.503)	0.176	–0.434 (–7.851 to 6.983)	0.909	2.435 (–7.753 to 12.623)	0.639	–1.065 (–6.610 to 4.480)	0.707
Nausea and vomiting	–5.331 (–8.619 to –2.044)	0.001*	–6.148 (–11.957 to –0.338)	0.038	1.491 (–2.299 to 5.280)	0.441	4.436 (–0.779 to 9.652)	0.095	–0.195 (–3.076 to 2.685)	0.894
Pain	–1.560 (–6.522 to 3.403)	0.538	–0.965 (–9.679 to 7.750)	0.828	2.126 (–3.586 to 7.839)	0.466	7.796 (–0.051 to 15.643)	0.052	4.129 (–0.135 to 8.393)	0.058
Dyspnea	1.993 (–4.297 to 8.283)	0.535	7.440 (–3.572 to 18.452)	0.185	–1.77 (–9.005 to 5.465)	0.632	8.658 (–1.270 to 18.586)	0.087	8.421 (3.068 to 13.774)	0.002*
Insomnia	–7.99 (–16.650 to 0.669)	0.071	–6.316 (–21.465 to 8.833)	0.414	–3.541 (–13.500 to 6.417)	0.486	0.127 (–13.534 to 13.788)	0.985	–2.713 (–10.065 to 4.640)	0.470
Appetite loss	–4.543 (–10.462 to 1.375)	0.132	–7.377 (–17.891 to 3.138)	0.169	4.580 (–2.250 to 11.409)	0.189	7.636 (–1.774 to 17.046)	0.112	3.033 (–2.236 to 8.302)	0.259
Constipation	–0.831 (–7.952 to 6.289)	0.819	–2.160 (–14.658 to 10.338)	0.735	–5.188 (–13.383 to 3.006)	0.215	–4.339 (–15.594 to 6.917)	0.450	–2.956 (–9.067 to 3.154)	0.343
Diarrhea	3.435 (–1.762 to 8.632)	0.195	–16.442 (–25.631 to –7.254)	<0.001*	1.514 (–4.477 to 7.506)	0.620	4.978 (–3.269 to 13.225)	0.237	–0.678 (–5.238 to 3.882)	0.771
Financial difficulties	4.450 (–4.89 to 13.79)	0.350	–7.100 (–23.421 to 9.221)	0.394	–2.981 (–13.724 to 7.762)	0.586	11.923 (–2.802 to 26.647)	0.113	4.553 (–3.349 to 12.456)	0.259
QLQ-STO22 symptom										
Dysphagia	–1.455 (–4.827 to 1.917)	0.398	–1.577 (–7.529 to 4.375)	0.604	–0.214 (–4.098 to 3.669)	0.914	3.193 (–2.154 to 8.54)	0.242	1.250 (–1.676 to 4.176)	0.402
Chest and abdominal pain	–2.052 (–6.040 to 1.935)	0.313	–0.833 (–7.850 to 6.185)	0.816	4.986 (0.394 to 9.577)	0.033	2.355 (–3.960 to 8.670)	0.465	–0.438 (–3.869 to 2.993)	0.802
Reflux symptoms	–2.393 (–5.817 to 1.031)	0.171	–1.086 (–7.137 to 4.966)	0.725	–3.162 (–7.104 to 0.781)	0.116	–1.987 (–7.421 to 3.446)	0.473	–1.177 (–4.146 to 1.793)	0.437
Eating restriction	–2.194 (–6.281 to 1.892)	0.293	–1.425 (–8.628 to 5.779)	0.698	4.265 (–0.440 to 8.970)	0.076	2.528 (–3.947 to 9.003)	0.444	1.862 (–1.671 to 5.394)	0.302
Having a dry mouth	–6.385 (–14.936 to 2.166)	0.143	2.983 (–11.998 to 17.964)	0.696	–1.672 (–11.506 to 8.162)	0.739	3.517 (–9.985 to 17.019)	0.610	–0.117 (–7.384 to 7.151)	0.975
Taste	–9.578 (–16.234 to –2.923)	0.005*	–9.469 (–21.222 to 2.285)	0.114	3.753 (–3.913 to 11.419)	0.337	–0.755 (–11.312 to 9.801)	0.888	–0.943 (–6.726 to 4.840)	0.749
Body image	4.578 (–2.603 to 11.759)	0.211	–7.475 (–20.116 to 5.166)	0.246	2.649 (–5.617 to 10.914)	0.530	–1.354 (–12.725 to 10.016)	0.815	–3.539 (–9.724 to 2.647)	0.262
Anxiety	–2.541 (–9.156 to 4.074)	0.451	–14.620 (–26.210 to –3.029)	0.013	4.787 (–2.820 to 12.393)	0.217	3.626 (–6.818 to 14.071)	0.496	–2.748 (–8.375 to 2.879)	0.339
Hair loss	–8.118 (–13.561 to –2.674)	0.003*	–7.595 (–17.174 to 1.983)	0.120	2.114 (–4.151 to 8.380)	0.508	–1.357 (–9.974 to 7.261)	0.758	–3.994 (–8.677 to 0.689)	0.095

Assessed using European Organization for Research and Treatment of Cancer Quality of Life Questionnaires (QLQ).
EST., estimate; CI, confidence interval.
*Significant difference ($P < 0.05$).

data for transparency. Third, EORTC assessments consist of a lot of questions so that the rate of questionnaire completion is relatively low. To boost the completion rate and the patient retention rate, reward programs can be considered for a future study. Lastly, this study lacked long-term results and the strategy to reduce the missing data or the cross-sectional study design may help this limitation. But when we reviewed the previous studies which showed that time trend is mainly associated with HRQoL in the early recovery period whereas HRQoL remains relatively stable after the 1st year following surgery [5,15,16,23], similar long-term results were expected.

Future research includes (1) nonlinear trend over the course of follow-up using the nonlinear mixed effects model; (2) the time-varying nutrition in the regression model to better understand the impact of the nutrition on the HRQoL of the patient.

In summary, elderly patients had lower score of physical functioning before surgery. Global health status/QoL, physical functioning, role functioning, and social functioning were deteriorated 1 month after gastrectomy and improved 3 months after gastrectomy. But those were not fully recovered. Age group significantly affected the scores of physical functioning and the difference last till 1-year after surgery.

In conclusion, elderly patients' QoL, especially physical functioning, was not completely recovered one year after gastrectomy unlike those of younger patients. Hence surgeons need to pay more attention to the elderly patients' QoL after gastrectomy.

SUPPLEMENTARY MATERIALS

Supplementary Fig. 1 can be found via https://doi.org/10.4174/astr.2021.100.1.8.

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Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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