Prevalence and Risk Factors of Preoperative Frailty in Chinese Elderly Inpatients with Gastrointestinal Cancer Undergoing Surgery: A Single-center Cross-sectional Study Using the Groningen Frailty Indicator

Qianqian Zhang
First Affiliated Hospital of Anhui Medical University
Meng Zhang
First Affiliated Hospital of Anhui Medical University
Shaohua Hu
First Affiliated Hospital of Anhui Medical University
Lei Meng
First Affiliated Hospital of Anhui Medical University
Jing Xi
Soochow University
Aman Xu
First Affiliated Hospital of Anhui Medical University
Yanyan Zhang
First Affiliated Hospital of Anhui Medical University
Shihui Yu (shihuiyuayfy@163.com)
First Affiliated Hospital of Anhui Medical University

Research Article

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Abstract

Background

Frailty is emerging as an important determinant for health. Compared with Western countries, research in the field of frailty started at a later stage in China and mainly focused on older community dwellers. Little is known about frailty in Chinese cancer patients, nor the risk factors of frailty. This study aimed to investigate the prevalence of frailty and its risk factors in elderly inpatients with gastrointestinal cancer.

Methods

This cross-sectional study was performed at a tertiary hospital in China from Mar. 2020 to Nov. 2020. The study enrolled 265 inpatients aged 60 and older with gastrointestinal cancer who underwent surgery. The demographic and clinical characteristics, biochemical laboratory parameters, and anthropometric data were collected from all patients. The Groningen Frailty Indicator was applied to assess the frailty status of patients. Multivariate logistic regression model analysis was carried out to identify risk factors of frailty and estimate their 95% confidence intervals.

Results

The prevalence of frailty in elderly inpatients with gastrointestinal cancer was 43.8%. A multivariate logistic regression analysis showed that older age (OR=1.065, 95% CI: 1.001-1.132, P=0.045), low handgrip strength (OR=4.346, 95% CI: 1.739-10.863, P=0.002), no regular exercise habit (OR=3.228, 95% CI: 1.230-8.469, P=0.017), and low MNA-SF score (OR=11.090, 95% CI: 5.119-24.024, P<0.001) were risk factors of frailty.

Conclusions

This study suggested that the prevalence of frailty was high among elderly inpatients with gastrointestinal cancer. Older age, low handgrip strength, no regular exercise habit, and low MNA-SF score were identified as risk factors of frailty.

Introduction

The aging population is accelerating rapidly. As of the end of 2017, there were 241 million people aged 60 and older in China, accounting for 17.3% of the total population[1]. Age is an important risk factor for cancer, as extended lifespan is accompanied by increased exposure to carcinogenic factors and the prolonged accumulation of genetic changes[2]. Gastric and colorectal cancers are commonly diagnosed cancers worldwide, respectively, ranking the third and fifth in terms of incidence but the second and third in terms of mortality, as reported in Global Cancer Statistics 2018[3]. A large proportion of new cancer cases in China are diagnosed at age 60 years and older[4], with age-related declines in immunity system[5], organs function, and physical performance[6], posing a challenge to promote recovery and reduce adverse clinical outcomes.

Frailty, the most problematic aspect of population aging[7], refers to the state of increased vulnerability for the development of increased dependency and/or death when being exposed to stressors[8]. Several studies have revealed that frailty is an important risk factor for the prediction of postoperative complications[9], readmission[10], and mortality[11] in cancer patients who accepted surgery. For those older cancer patients, the internal complicated biological changes of aging along with immune senescence, inflammation, age-related chronic diseases, and external environmental and psychosocial factors have a significant impact on the development of individual malignancies and their physiological reserves and vulnerability[12]. Besides, frailty was also significantly associated with worse long-term health-related quality of life in older patients with breast cancer[13]. As we all know, the cancer itself and treatments can be significant stressors that challenge the physiological reserves of older patients, all of which can increase the risk of frailty. It is also challenging for clinical staff to decide the optimum treatment for older patients who are heterogeneous in terms of comorbidities, disability, physical reserves, and geriatric conditions[14]. Therefore, the geriatric frailty assessment should be used to provide an appropriate surgical risk assessment for clinical staff to help guide cancer treatments.

Although there is no golden standard for the assessment of frailty[15], several common frailty tools have been used in clinical practices. The comprehensive geriatric assessment (CGA) is a systematic procedure for the detection of vulnerability in elderly patients with cancer that focuses on functional, somatic, and psychosocial domains[14]. However, conducting CGA is time-consuming[14] and may not be feasible in an oncology ward with limited resources. The Groningen Frailty Indicator (GFI), originally developed by Steverink et al[16], is a frailty screening tool with good predictive performance[17], and it has been widely used for screening frailty in cancer patients. Recently, Xiang et al[18] has translated the GFI into Chinese, and the Chinese GFI displays good internal consistency (Cronbach's α = 0.712), excellent test-retest reliability (ICC = 0.939), and satisfactory criterion validity (AUC = 0.823) among Chinese nursing home residents.

Compared with Western countries, research in the field of frailty started at a later stage in China and mainly focused on older community dwellers[19]. Recent studies have reported that the prevalence of frailty among Chinese community residents aged 60 and older, ranged from 38.6–60.5% based on the GFI criterion[18, 20]. A meta-analysis by He et al[21] showed that being female, increasing age, ADL disability, and developing three or more chronic diseases were risk factors for frailty in older community dwellers. However, to our best knowledge, there is little known about the prevalence of frailty in cancer patients in China, nor the risk factors of frailty. Therefore, the aim of this study was to investigate the prevalence of preoperative frailty in elderly inpatients with gastrointestinal cancer and further explore the factors that were associated with frailty in this population.

Material And Methods

Study design and participants

This was a cross-sectional study to assess the prevalence of frailty and its risk factors in patients with gastrointestinal cancer. The patients who successfully underwent surgery participated in this study and they were all consecutively recruited from the First Affiliated Hospital of Anhui Medical University (Anhui province, China) from Mar. 2020 to Nov. 2020. The inclusion criteria were as follows: (1) with diagnosed gastric or colorectal cancer; (2) ≥ 60 years old; (3) had normal function of limb movement; (4) signed informed consent. The exclusion criteria were as follows: (1) postoperative histopathology confirmed the diagnosis of precancerous or mesothelioma or benign lesions; (2) with recurrent gastric or colorectal cancer; (3) admitted to hospital with acute intestinal obstruction or massive alimentary tract bleeding; (4) had severe heart and lungs diseases with no surgical indications.

Ethical consideration

Ethical approval was granted from the Clinical Medical Research Ethics Committee of the First Affiliated Hospital of Anhui Medical University (PJ2020-03-29). This study conformed to the standards of the Declaration of Helsinki and was registered with the Chinese Clinical Trial Registry (ChiCTR2000031250).

Laboratory parameters

After a 12-h overnight fast, all patients' preoperative venous blood samples, including *blood routine* (white blood cell, WBC; red blood cell, RBC; hemoglobin, HGB; reticulocyte, RET; lymphocyte, LYMPH), *plasma protein* (prealbumin, PA; albumin, ALB; globulin, GLO; total protein, TP), and *tumor markers* (alpha-fetoprotein, AFP; carcino-embryonic antigen, CEA; carbohydrate antigen 125, CA125; carbohydrate antigen 19 – 9, CA19-9; carbohydrate antigen 72 – 4, CA72-4), were collected together in the morning. Blood routine, plasma protein, and tumor markers were detected with an automatic blood analyzer (XN-9000, Sysmex, Japan), an automatic chemistry analyzer (Cobas 8000, Roche, Germany), and an automatic electrochemiluminescence immunoassay analyzer (Cobas 6000, Roche, Germany), respectively. Tumor area, stage, and histological grade were also collected after finishing surgery.

Demographic and clinical characteristics

A self-designed questionnaire that included age, sex, body mass index (BMI), educational background, marital status, smoking/drinking history, past medical history, regular exercise habit, cancer type, preoperative chemoradiotherapy, and blood transfusion before or after surgery, was used to collect the general demographic and clinical data of all patients. Regular exercise habit is defined as participants who did at least 30 minutes of moderate-intensity exercise (e.g., jogging, brisk walking) per time, with no less than 5 times per week. Smoking/Drinking history is defined as the patients who are currently smoking/drinking, or they used to smoke/drink, but they now quit smoking/drinking.

GFI questionnaire

Frailty was measured with the self-report version of GFI that has been revised by Peters et al[22], and it contains 15 items on physical, cognitive, social, and psychological domains. The answer to each item has a score of either 0 or 1, with 1 indicating a dependent problem. The total score of GFI ranges from 0 to 15, with higher scores indicating greater frailty. The cut-off value of GFI ≥ 3 was considered frail in

geriatric oncology[17]. The GFI was proved to show moderate internal consistency (Cronbach's α ranged from 0.68 to 0.712.)[18, 22]. All patients filled out the GFI questionnaires within three days of their hospital admission for surgery. The revised and Chinese versions of GFI were supplemented in Appendix A.

Short-Form Mini-Nutritional Assessment (MNA-SF) questionnaire

The MNA-SF, revised by Rubenstein et al[23] based on the Mini-Nutritional Assessment, is a validated tool to screen malnourished hospitalized patients. The sensitivity, specificity, and diagnostic accuracy of MNA-SF for the prediction of malnutrition were 97.9%, 100%, and 98.7%, respectively[23]. It contains 6 items, namely, weight loss, body mass index, stress or illness, mobility, dementia or depression, and loss of appetite. The total score of MNA-SF ranges from 0 to 14, with the score > 11 (≤11) being well-nourished (at risk of malnutrition or malnourished). The trained researchers routinely obtained patients' MNA-SF scores within three days of their hospital admission for surgery.

Handgrip strength

Preoperative handgrip strength was measured in kilograms (Kg) with a handheld dynamometer based on the digital strain gauge sensors (Jamar® Plus+, Performance Health Supply, Inc., Cedarburg, WI, USA). Measurements were conducted with the patient seated, shoulders adducted and neutrally rotated, elbow in 90° flexion, and the forearm and twist in a neutral position[24]. All patients were asked to squeeze the dynamometer as much as possible with the dominant hand. Two tests were performed with a rest interval of at least 30 seconds, and the maximum value of the two tests was recorded. If the two results differed by over 10%, a third test would be carried out. Low handgrip strength is defined as < 26 kg for male and < 18 kg for female[25].

4-Meter Walk Test

Preoperative walking speed was performed through a 4-meter walk test, with an additional two meters being added at the beginning and the end of the walkway that was provided for accelerating or decelerating[26]. Patients in standing still position were asked to walk at their usual pace (normal gait speed) with or without using auxiliary aids (e.g., canes, walkers). Walking time was measured by a trained researcher with a digital stopwatch (PS-60, China) from the moment that the patient's first foot crossed the 2-m line until the moment that the patient's first foot completely crossed the 6-m line. The test was performed twice, and the shortest time was applied for analysis. Slow gait speed is defined as ≤0.8 m/s[25].

Mid-Upper Arm Circumference (MUAC) and Calf Circumference (CC)

Preoperative MUAC and CC were measured to the nearest 0.1 cm with a non-elastic tape (Deli, China) without compressing the subcutaneous tissue. MUAC was measured at the mid-point around the arm

between the acromion and the ulnar olecranon, with the patient's upper limb in a state of natural hanging[27]. CC was measured around the widest part of the calf, while subjects stood with their legs shoulder-width apart[27].

Statistical analysis

The Kolmogorov-Smirnov test was conducted to verify the normal distribution of continuous variables. All data were expressed as mean ± standard deviation, or median and inter-quartile range, or frequency and percentages. Differences in demographic and clinical characteristics and biochemical laboratory parameters data between frail and non-frail patients were tested using two independent-samples *t* test or non-parametric test or chi-square test. To determine risk factors that were associated with frailty and estimate their 95% confidence intervals (CI), independent variables with a P value < 0.05 (was set at a stringent level) on univariate analysis as described above were entered into a multivariate logistic regression model analysis by adopting the Forward LR method. Data analyses were performed with SPSS 23.0 software package (IBM, Armonk, NY, USA). A two-tiled P value < 0.05 was considered statistically significant.

Results

Demographic and clinical characteristics in all patients

Overall, 330 patients from the gastrointestinal surgery ward were screened, among which 65 patients did not meet the inclusion criteria. Hence, 265 patients were included in the final analysis (Fig. 1), with 116 (43.8%) in the frail group and 149 (56.2%) in the non-frail group.

As seen in Table 1, when compared with the non-frail group, the frail group tended to be older and contained more females (less male) (P < 0.05). MUAC, CC, 4-m gait speed (Slow gait speed: 24.1% *vs.* 8.7%), handgrip strength (Low strength: 31.9% *vs.* 5.4%), and MNA-SF score (Low score: 91.4% *vs.* 47.7%) were significantly lower in the frail group than that in the non-frail group (P < 0.05). The frail group had significantly less regular exercise habits (79.3% *vs.* 92.6%) and more blood transfusion before or after surgery (23.3% *vs.* 12.1%) compared with the non-frail group (P < 0.05). However, no significant differences in BMI, education, marital status, smoking/drinking history, Charlson comorbidity index, and preoperative chemoradiotherapy were found between the two groups of subjects (P > 0.05).

Table 1
Subjects' demographic and clinical characteristics

	Non-frail (*n* = 149)	Frail (*n* = 116)	*t*/Z/χ^2	*P* value
Age (years)	68 (65, 73)	71 (66, 75)	-2.592	0.010*
BMI (kg/m^2)	21.97 (19.84, 23.88)	20.99 (19.40, 23.27)	-1.844	0.065
MUAC (cm)	26.76 ± 2.95	26.01 ± 2.79	2.099	0.037*
CC (cm)	33.03 ± 2.79	32.15 ± 2.87	2.501	0.013*
Sex, *n* (%)			8.515	0.004*
Male	119 (79.9)	74 (63.8)		
Female	30 (20.1)	42 (36.2)		
Education, *n* (%)			-1.742	0.082
Elementary school or below	97 (65.1)	87 (75.0)		
Middle school	31 (20.8)	18 (15.5)		
High school or above	21 (14.1)	11 (9.5)		
Marital status, *n* (%)			0.557	0.456
Married	141 (94.6)	112 (96.6)		
Widowed	8 (5.4)	4 (3.4)		
Smoking history, *n* (%)			1.717	0.190
No	65 (43.6)	60 (51.7)		
Yes	84 (56.4)	56 (48.3)		
Drinking history, *n* (%)			1.921	0.166
No	72 (48.3)	66 (56.9)		
Yes	77 (51.7)	50 (43.1)		
Charlson comorbidity index, *n* (%)			1.854	0.173
<3	97 (65.1)	66 (56.9)		
≥3	52 (34.9)	50 (43.1)		
Have regular exercise habit, *n* (%)			10.075	0.002*

*: Frail *vs.* Non-frail, $P < 0.05$.

	Non-frail (*n* = 149)	Frail (*n* = 116)	*t*/Z/χ^2	*P* value
No	11 (7.4)	24 (20.7)		
Yes	138 (92.6)	92 (79.3)		
4-m gait speed, *n* (%)			11.848	0.001*
>0.8 m/s	136 (91.3)	88 (75.9)		
≤0.8 m/s	13 (8.7)	28 (24.1)		
Handgrip strength, *n* (%)			32.557	< 0.001*
≥26 kg (male), ≥18 kg (female)	141 (94.6)	79 (68.1)		
<26 kg (male), < 18 kg (female)	8 (5.4)	37 (31.9)		
Preoperative chemoradiotherapy, *n* (%)			0.054	0.816
No	141 (94.6)	109 (94.0)		
Yes	8 (5.4)	7 (6.0)		
Blood transfusion before or after surgery, *n* (%)			5.799	0.016*
No	131 (87.9)	89 (76.7)		
Yes	18 (12.1)	27 (23.3)		
MNA-SF score, *n* (%)			56.229	< 0.001*
>11	78 (52.3)	10 (8.6)		
≤11	71 (47.7)	106 (91.4)		

*: Frail *vs.* Non-frail, $P < 0.05$.

Biochemical laboratory parameters in all patients

The comparisons of biochemical laboratory parameters between the two groups were shown in Table 2. HGB, PA, and ALB were significantly lower in the frail group than that in the non-frail group ($P < 0.05$), while the tumor area was significantly higher in the frail group than that in the non-frail group ($P < 0.05$). However, no significant differences in WBC, RBC, RET, LYMPH, GLO, TP, AFP, CEA, CA125, CA19-9, CA72-4, cancer type, T stage, N stage, M stage, histological grade, and signet ring cells on histological examination were discovered between the two groups of subjects ($P > 0.05$).

Table 2
Subjects' biochemical laboratory parameters

	Non-frail (n = 149)	Frail (n = 116)	t/Z/c^2	P value
WBC (×10^9/L)	5.49 (4.55, 6.53)	5.55 (4.60, 6.63)	-0.638	0.523
RBC (×10^12/L)	4.05 (3.74, 4.52)	4.04 (3.52, 4.34)	-1.878	0.060
HGB (g/L)	124.00 (110.00, 140.00)	118.50 (94.00, 129.75)	-3.191	0.001*
RET (×10^12/L)	0.0640 (0.0490, 0.0855)	0.0620 (0.0503, 0.0788)	-0.763	0.446
LYMPH (×10^9/L)	1.59 (1.30, 1.98)	1.53 (1.22, 1.92)	-1.146	0.252
PA (mg/L)	214.50 ± 51.04	193.33 ± 55.35	3.228	0.001*
ALB (g/L)	40.60 (39.05, 42.75)	40.10 (36.50, 42.18)	-2.517	0.012*
GLO (g/L)	25.40 (23.10, 27.75)	25.25 (23.23, 28.78)	-0.665	0.506
TP (g/L)	66.23 ± 5.00	65.65 ± 6.69	0.773	0.441
AFP (ng/mL)	2.02 (1.31, 3.10)	1.89 (1.09, 2.80)	-1.344	0.179
CEA (ng/mL)	3.49 (1.82, 6.56)	3.16 (1.79, 7.16)	-0.057	0.954
CA125 (U/mL)	10.95 (8.22, 16.35)	11.67 (8.07, 19.49)	-1.142	0.253
CA19-9 (U/mL)	11.11 (6.83, 20.92)	10.94 (6.19, 19.57)	-1.036	0.300
CA72-4 (U/mL)	1.82 (1.01, 5.39)	2.29 (1.19, 6.95)	-1.326	0.185
Tumor area (cm^2)	12.00 (6.43, 22.25)	18.00 (9.00, 29.38)	-3.453	0.001*
Cancer type, n (%)			4.865	0.088
Rectum	21 (14.1)	28 (24.1)		
Colon	24 (16.1)	20 (17.2)		
Stomach	104 (69.8)	68 (58.6)		
T stage, n (%)			-0.299	0.765
1	13 (8.7)	17 (14.7)		

*: Frail *vs.* Non-frail, $P < 0.05$.

	Non-frail (*n* = 149)	Frail (*n* = 116)	*t*/Z/c^2	*P* value
2	19 (12.8)	16 (13.8)		
3	78 (52.3)	47 (40.5)		
4	39 (26.2)	36 (31.0)		
N stage, *n* (%)			-1.161	0.246
0	60 (40.3)	56 (48.3)		
1	32 (21.5)	21 (18.1)		
2	30 (20.1)	21 (18.1)		
3	27 (18.1)	18 (15.5)		
M stage, *n* (%)			0.620	0.431
0	141 (94.6)	107 (92.2)		
1	8 (5.4)	9 (7.8)		
Histological grade, *n* (%)			-1.572	0.116
Highly differentiated	2 (1.3)	6 (5.2)		
Moderately differentiated	72 (48.3)	61 (52.6)		
Poorly differentiated	75 (50.3)	49 (42.2)		
Signet ring cells on histological examination, *n* (%)			1.108	0.293
Absent	140 (94.0)	105 (90.5)		
Present	9 (6.0)	11 (9.5)		

*: Frail *vs.* Non-frail, $P < 0.05$.

Descriptions of variable assignment

The assignment of dependent and significant independent variables was described in Table 3.

Table 3
Descriptions of variables assignment

Variables	Description
Age	Continuous variable
MUAC	
CC	
HGB	
PA	
ALB	
Tumor area	
Frailty status	Non-frail = 0, Frail = 1
Sex	Female = 0, Male = 1
Have regular exercise habit	Yes = 0, No = 1
4-m gait speed	> 0.8 m/s = 0, ≤0.8 m/s = 1
Handgrip strength	≥26/18 kg (male/female) = 0, < 26/18 kg (male/female) = 1
Blood transfusion before or after surgery	No = 0, Yes = 1
MNA-SF score	> 11 points = 0, ≤11 points = 1

Risk factors of frailty in patients with gastrointestinal cancer

The multivariate logistic regression analysis showed that older age (OR = 1.065, 95% CI: 1.001–1.132, P = 0.045), low handgrip strength (OR = 4.346, 95% CI: 1.739–10.863, P = 0.002), no regular exercise habit (OR = 3.228, 95% CI: 1.230–8.469, P = 0.017), and low MNA-SF score (at risk of malnutrition or malnourished) (OR = 11.090, 95% CI: 5.119–24.024, P < 0.001) were identified as risk factors of frailty in patients with gastrointestinal cancer (see Fig. 2).

Discussion

This study currently investigated the frailty status of elderly inpatients with gastrointestinal cancer with a GFI instrument and analyzed its risk factors. The results showed that the prevalence of frailty was 43.8%, and that older age, low handgrip strength, no regular exercise habit, and low MNA-SF score were risk factors of frailty.

To date, the prevalence of frailty in patients with cancer is inconsistent worldwide. A systematic review that pooled 20 studies evaluating 2,916 older cancer patients mainly from North America and Europe,

suggesting that the median prevalence of frailty was 42%[28], which was similar to the result of this study. However, that review also revealed that the prevalence of frailty varies greatly among different studies (range 6%-86%) due to the differences in the content and approach of frailty assessment[28]. For cancer patients, the cancer itself can be a significant stressor that challenges patients' physiologic reserve, and thus the prevalence of frailty in older cancer patients is usually higher[29]. In addition, various cancer types (e.g., urological, colorectal, breast, lung), assessment instruments (e.g., CGA, phenotype, GFI, FRAIL, FI), and research sites (e.g., inpatient, outpatient, general practice) may also contribute to the differences of frailty prevalence in this population[28, 29]. Chinese researchers have reported that the prevalence of frailty among elderly inpatients ranged from 18–36.2%[19, 30]. However, no detailed information on the diseases of inpatients was provided. Another Chinese study suggested that the prevalence of frailty in patients with gastric cancer aged 80 and over was 32.7% based on the three baseline frailty traits, namely, albumin, hematocrit, and creatinine[9]. Given the inconsistent results on the prevalence of frailty, and especially higher frailty prevalence in cancer patients, clinical staff should promptly assess frailty status and subsequently take effective measures to reduce the burden of frailty on this population.

Age is an important risk factor of frailty in this study. A systematic review showed that the risk of frailty in the elderly people increased significantly with the increase of age[21]. As previously mentioned, older patients experienced much more age-related biological changes, multiple diseases, treatment of diseases, and the effects of social-psychological factors that may ultimately lead to the onset of frailty[12]. The aging process can be depicted as a time-dependent decline in physiological organ function, thus resulting in the development of diseases, including cancer[31]. To a certain extent, the related toxicity of cancer treatment caused significant impairments in the body function and some evidence proved that cancer treatment might be associated with accelerated aging[32]. Considering these facts, aging, cancer, and cancer treatment might interact with the onset of frailty.

Low handgrip strength was identified as an important risk factor of frailty in the present study. Handgrip strength serves as a reliable proxy index of an individual's hand motor abilities[33], and measuring handgrip strength is a simple and feasible measure of muscle strength[25]. Xue et al[34] conducted a prospective cohort study of 352 elderly women and observed that lower baseline handgrip strength was significantly associated with the higher risk of frailty, which was consistent with our findings. Interestingly, Puts et al[35] put forward that in newly diagnosed elderly patients with cancer, only low grip strength could predict therapeutic toxicity, which may help physicians gain insight into the effects of cancer treatments. In addition, for older adults of the same age, handgrip strength might be a single marker of frailty that was more important than chronological age alone[36], and it has been proved to be a valuable screening tool for frailty in older patients with newly diagnosed hematological cancer[37]. Based on these facts, we can understand that handgrip strength is closely connected with frailty in normal individuals or cancer patients.

No regular exercise habit usually meant physical inactivity or being sedentary, and it was significantly associated with frailty in our study. Haider et al[38] suggested that performing no regular physical activity

was substantially correlated with the higher risk of frailty in community dwellers, which was in line with our findings. Besides, da Silva et al[39] indicated that frailty prevalence significantly increased with physical inactivity combined with excessive time spent in sedentary behavior in older adults. Hopefully, accumulating studies[40, 41] gave the information that physical activity offered a model of improving the function of dysregulated multiple physiologic systems, thus preventing or alleviating the progress of frailty.

Low MNA-SF score implied that these patients were at risk of malnutrition or malnourishment, which was an important risk factor of frailty in the present study. Our results were consistent with a previous study[42] that expressed that low MNA score (at risk of malnutrition/malnourished) was substantially correlated with frailty (OR = 2.72 and OR = 17.4, respectively) among 5,685 older community residents in Singapore. Recently, Liu et al[43] showed that poor nutritional status was associated with an increased risk of frailty (OR = 2.66) among 705 Chinese nursing home residents. Meanwhile, Gabrovec et al[44] also highlighted that malnutrition or being at risk of malnutrition were risk factors of frailty in aging. However, Zhang et al[45] revealed that frailty was significantly associated with the risk of malnutrition (OR = 3.82) in older cancer patients. We speculated that the close connection between frailty and malnutrition in cancer patients might be attributed to similar factors, including physical performance, weight loss, sociodemographic and clinical characteristics. Notably, the causal relationship between malnutrition and frailty requires clinical researches to make clear. Given the fact that malnutrition is common in older cancer patients, and is mostly caused by tumor invasion, side effects of cancer treatment, cachexia, and anorexia of aging. Consequently, there is an urgent need for clinical staff to early identify malnutrition in these patients and take targeted therapy to improve their nutritional status.

Although we hoped to explore some specific disease-related risk factors of frailty among these elderly cancer patients, the findings of this study only displayed some non-specific common factors in this population. As a result, there are several inevitable limitations in our study. Firstly, we did not detect laboratory biomarkers, just as several potential biomarkers that may be involved in the development of frailty. Secondly, this was an observational study and the underlying cellular and molecular mechanisms of frailty were far from being understood, thus necessitating further researches to elucidate this. Thirdly, this study was performed at a single center, and multicenter studies should be conducted soon. Besides, the long-term outcomes of patients such as complications and mortality should also be concerned in the future.

In conclusion, the prevalence of frailty is high among elderly inpatients with gastrointestinal cancer in this study. Older age, low handgrip strength, no regular exercise habit, and low MNA-SF score are risk factors of frailty. Frailty is emerging as an important determinant for health and the mentioned risk factors should be considered when implementing interventions to improve the health outcomes of frail cancer patients.

Declarations

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Conflicts of interest

All authors have no conflict of interest and no financial associations to disclosure.

Availability of data and material

The datasets used or analyzed during the current study are available from the corresponding author after the paper is published.

Code availability

N/A.

Authors' contributions

Study concepts and design: Qianqian Zhang, Yanyan Zhang, Shihui Yu, and Aman Xu;

Data acquisition: Qianqian Zhang and Meng Zhang;

Quality control of data and algorithms: Shihui Yu and Aman Xu;

Data analysis and interpretation: Meng Zhang and Shaohua Hu;

Statistical analysis: Lei Meng and Jing Xi;

Manuscript preparation: Qianqian Zhang, Shaohua Hu;

Manuscript editing: Jing Xi, Lei Meng, and Yanyan Zhang;

Manuscript review: Shihui Yu and Aman Xu.

Ethics approval

This study was approved by the Clinical Medical Research Ethics Committee of the First Affiliated Hospital of Anhui Medical University (PJ2020-03-29) and complied with the Declaration of Helsinki.

Consent to participate

All participants were fully informed about the research purpose before they provided signed consent.

Consent for publication

All authors critically reviewed the manuscript and approved the final version submitted for publication.

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Figures

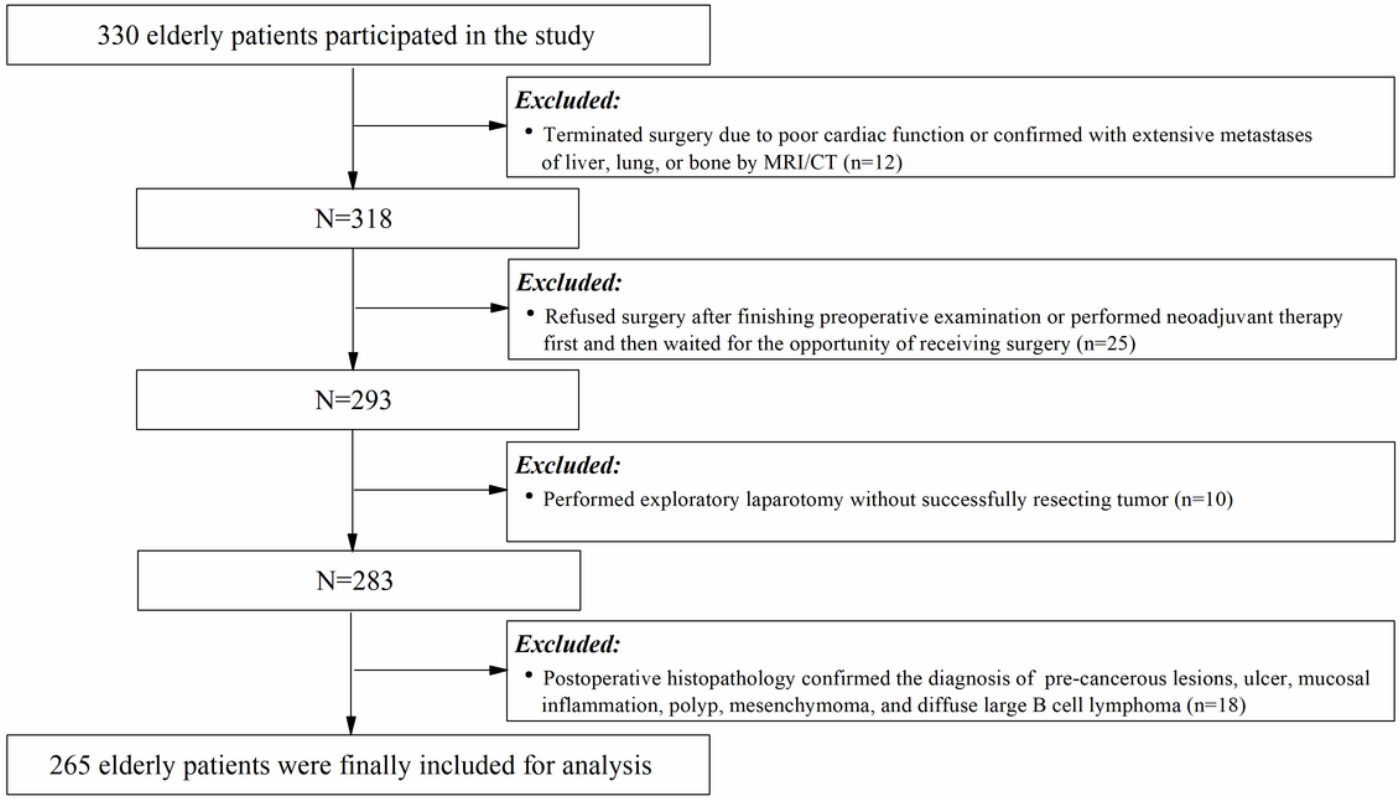

Figure 1

265 patients were included in the final analysis

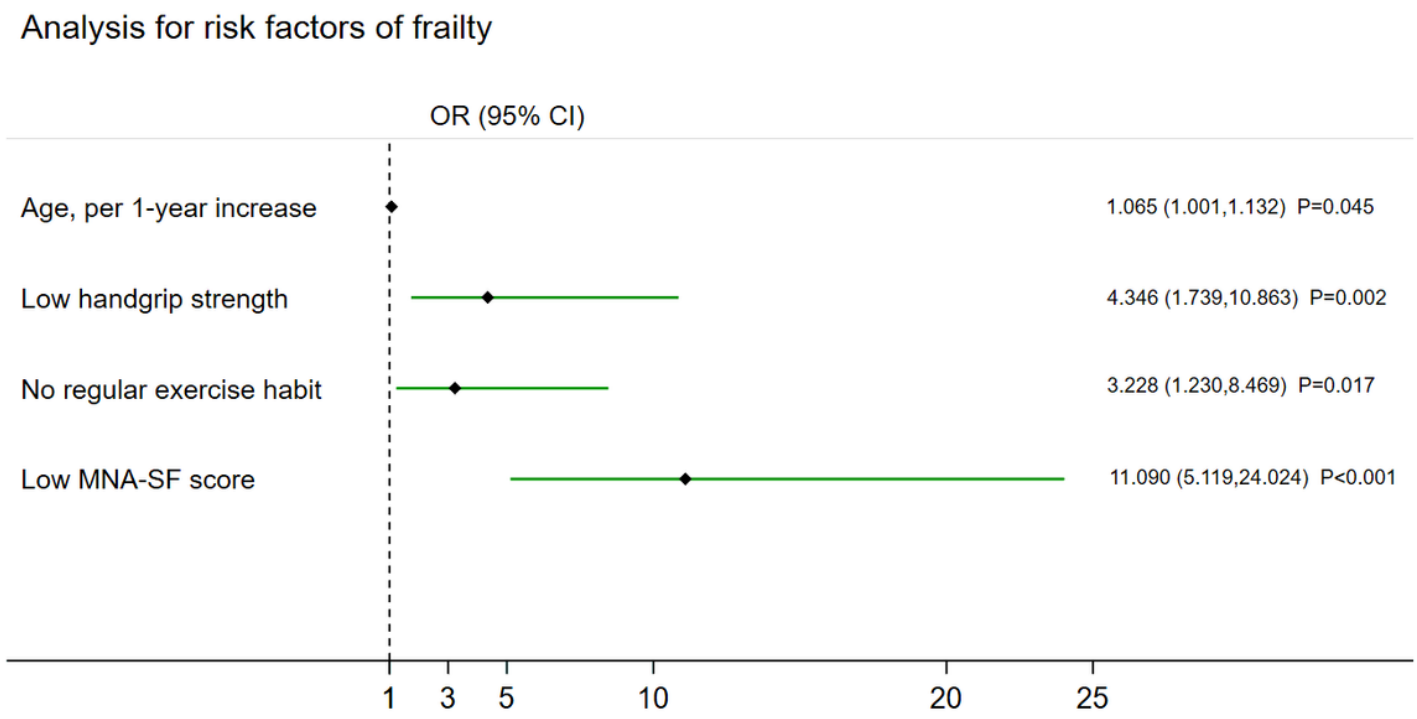

Figure 2

The multivariate logistic regression analysis showed that older age (OR=1.065, 95% CI: 1.001-1.132, P=0.045), low handgrip strength (OR=4.346, 95% CI: 1.739-10.863, P=0.002), no regular exercise habit (OR=3.228, 95% CI: 1.230-8.469, P=0.017), and low MNA-SF score (at risk of malnutrition or malnourished) (OR=11.090, 95% CI: 5.119-24.024, P<0.001) were identified as risk factors of frailty in patients with gastrointestinal cancer

Supplementary Files

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- AppendixA.docx