Preoperative Nutritional Status and Risk Factors Associated with Delayed Discharge in Geriatric Patients Undergoing Gastrectomy: A Single-Center Retrospective Study

Xining Zhao

Zhongshan Hospital Fudan University <https://orcid.org/0000-0001-9726-9556>

Jie Liu

Zhongshan Hospital Fudan University

Ying Wang

Zhongshan Hospital Fudan University

Yuying Yang

Zhongshan Hospital Fudan University

Yan Pan

Zhongshan Hospital Fudan University

Shengjin Ge (✉ ge.shengjin@zs-hospital.sh.cn)

Zhongshan Hospital Fudan University

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Abstract

Background

Preoperative malnutrition is an independent risk factor for postoperative complications and survival for gastric cancer (GC) patients. This study aimed to investigate the prevalence of malnutrition and the risk factors associated with the delayed discharge of geriatric patients undergoing gastrectomy.

Material and Methods

A retrospective study of GC patients (age ≥ 65) who underwent gastrectomy at Zhongshan Hospital from January 2018 to May 2020 was conducted. Clinical data, including demographic information, medical history, surgery-related factors, and perioperative nutritional management were collected and analyzed.

Results

A total of 783 patients were reviewed. The overall frequency of malnutrition was 31.3% (249/783). The levels of albumin, prealbumin, and hemoglobin were lower in the malnutrition group compared with the well-nourished group. Moreover, 51 (6.5%) patients received preoperative total parenteral nutritional support. All patients received postoperative parenteral nutrition; 194 (77.9%) patients in the malnutrition group received an infusion of carbohydrates with composite amino acid and 55 (22.1%) received total nutrient admixture. No significant difference was found in the duration of postoperative nutrition between the groups ($P>0.05$). The malnutrition group was associated with a higher rate of surgical site infections (SSIs) ($P<0.001$). Multivariate cox regression revealed that age >70 years, length of surgery >180 min, and postoperative complications were significant risk factors associated with delayed discharge.

Conclusion

Malnutrition is relatively common in elderly patients undergoing gastrectomy. Age, length of surgery, and postoperative complications are important risk factors associated with delayed discharge. Elderly GC patients with risk factors urgently require specific attention to shorten hospital stays.

Introduction

Gastric cancer (GC) is the fifth most common cancer worldwide [1], and the second most frequent cause of mortality in China [2]. The population of elderly patients with GC has been increasing because of the high prevalence of *Helicobacter pylori* (*H. pylori*) infection. Advanced age is associated with poor outcomes after surgical treatment, such as a higher rate of morbidity and postoperative complications [3].

The prevalence of malnutrition is about 12.6-19% in China [4-6]. Malnutrition is one of the major risk factors influencing adverse clinical outcomes in elderly GC patients [7]. The condition can be caused by mechanical obstruction of the digestive tract or anorexia-cachexia syndrome, leading to insufficient protein or energy intake and absorption disorder. Nutrition screening, assessment, and intervention are important steps in nutritional management.

Previous studies mostly focused on hospitalized medical patients [8], and only a few focused on surgical patients regardless of age [6]. Therefore, in this retrospective study, we investigated the nutritional status and perioperative nutritional support of geriatric surgical patients with GC, and provide a basis for implementing an effective nutritional intervention.

Methods

Study design and participants

The research project was approved by the Ethics Committee of Zhongshan Hospital (B2021-392) and was conducted in accordance with the Declaration of Helsinki. The clinical records of elderly patients aged ≥ 65 years with GC who underwent gastrectomy between May 2018 and May 2021 at Zhongshan Hospital affiliated to Fudan University were retrospectively identified. Patients with other malignancies, previous gastrointestinal surgery, or incomplete medical record were excluded.

Clinical data, including demographic information, medical history, laboratory tests, postoperative complications, lengths of hospital stay, and hospitalization cost, were collected and analyzed. Postoperative surgical complications were graded according to the Clavien-Dindo (CD) classification, and Grade II or higher were regarded as complications.

Definition and assessment of malnourished patients

Malnutrition was defined according to the European Society for Clinical Nutrition and Metabolism (ESPEN) diagnostic criteria [9] as a weight loss of $>10\%$ (indefinite of time) or $>5\%$ over the last 3 months and a body mass index (BMI) of $<20 \text{ kg/m}^2$ or $<22 \text{ kg/m}^2$ in patients under or above the age of 70, respectively. Nutritional assessment was performed based on a prognostic nutritional index (PNI), which is widely applied for evaluating the nutritional status of GC patients [10]. The PNI was calculated based on the equation: $[(10 \times \text{serum albumin (g/dL)}) + (0.005 \times \text{total lymphocyte count (/mm}^3\text{)})]$. The composition and duration of nutritional management were recorded and analyzed.

Statistical analysis

All statistical analyses were performed using SPSS ver. 22.0 (IBM SPSS, Chicago, USA). Normal distribution measurement data were expressed as mean $\pm$ SD, and a t-test was used to compare

differences between groups. The measurement data of skewed distribution were expressed as median (interquartile range), and the categorical variables were expressed as counts and percentages and compared using the χ^2 test. Univariate and multivariate analysis was carried out using logistic regression. A p-value <0.05 was considered statistically significant.

Results

Patient characteristics

A total of 783 patients were included in this study. Patient characteristics are shown in Table 1. The median age at diagnosis was 70 years (range: 64-86 years). The proportion of male individuals was 584 (74.6%). Among the 783 patients, 76 (9.7%) suffered from 3 or more chronic diseases. A total of 132 (16.9%) patients received preoperative consultation because of comorbidities.

Malnutrition

The frequency of malnutrition is shown in Table 1. The overall frequency of malnutrition was 31.8%. The age in the malnourished group (M group) was significantly higher than that in the well-nourished group (W group). No difference between the two groups in terms of the number of patients with 3 or more preoperative comorbidities ($P = 0.986$) and gender ratio ($P = 0.092$). Significant differences were found between the two groups in the level of albumin, prealbumin, hemoglobin, and PNI ($P < 0.05$).

Preoperative nutritional support

Of the 706 patients, 382 (54.1%) patients received nutritional support (Table 2). Of the 221 patients with malnutrition, 68 (30.8%) patients received a single nutritional infusion and 28 (12.7%) received total parenteral nutrition (TPN). Of the 485 patients without malnutrition, 268 (55.3%) patients received a single infusion and 18 (3.7%) received TPN. The composition of nutritional support was mainly carbohydrates. The rate of TPN was higher in the M group than in the W group ($P < 0.001$).

Postoperative nutritional support

All patients received parenteral nutrition after surgery. Of the 249 malnutrition patients, 194 (77.9%) patients received a single infusion of carbohydrates with or without composite amino acid, and 55 (22.1%) patients received total nutrient admixture (TNA). In patients with normal nutrition, 355 (66.5%) patients received a single infusion and 179 (33.5%) patients received TNA. No significant differences were found in rates or duration of postoperative nutrition between the two groups ($P > 0.05$).

Postoperative complications

Postoperative complications, hospital stay, and total cost of hospitalization are shown in Table 2. No significant differences were found in surgical site infection (SSI), pneumonia, bleeding, bowel obstruction, in-hospital mortality, or re-admission within 30 days ($P>0.05$). The malnutrition group was associated with a higher incidence rate of venous thrombosis ($P = 0.003$) and prolonged length of hospital stay ($P = 0.009$).

Discussion

In the present study, the prevalence of preoperative malnutrition in elderly patients undergoing gastrectomy was 31.3%, which was relatively high compared with that in previous studies [6]. The observed differences in malnutrition prevalence could be attributed to several factors, including instruments, age distribution, hospital location, and patient characteristics. Compared with well-nourished patients, those with preoperative malnutrition were associated with low levels of albumin, prealbumin, and hemoglobin. Furthermore, malnourished elderly patients were associated with higher postoperative complications and prolonged length of hospital stay compared with well-nourished patients. There was no significant difference in composition and timing of postoperative nutritional management between malnourished and well-nourished patients.

Malnutrition is one of the most crucial risk factors for postoperative complications [11]. In elderly GC patients, malnutrition is often caused by frailty, absorption disorder, and a decrease in food intake [12]. These patients often develop anemia, hypoproteinemia, and electrolyte abnormalities before surgery. Therefore, screening and assessment of malnutrition is an important step for all patients scheduled for major gastrointestinal surgery. Preoperative PNI is an independent prognostic factor for disease-free survival along with age and TNM stage in GC patients after surgery [13], and measurement of albumin and lymphocyte count is simple and convenient.

The guidelines of both the American Society for Parenteral and Enteral Nutrition (ASPEN) and ESPEN recommend oral or enteral feeding whenever possible [14, 15]. Enteral nutrition is preferred over parenteral nutrition because of a lower incidence of SSI [16]. However, in patients with a pyloric obstruction or inadequate energy supply by enteral nutrition, peripheral parenteral nutrition or TPN is often performed [14]. In our study, the rate of preoperative TPN in patients with malnutrition was significantly higher than that in well-nourished patients. However, the total rate of preoperative parenteral nutrition support was still low (43.5%) in patients with malnutrition. Optimal preoperative management for elderly patients with malnutrition is essential to improve surgical outcomes.

Although early initiation of oral or enteral feeding has been recommended to improve clinical outcomes and reduce surgical complications in GC patients following gastrectomy [14, 17], the postoperative nutritional support for patients is quite variable between different surgical teams. In the statement of the Japanese Gastric Cancer Treatment Guideline, the drink should be offered after postoperative day 1 and a solid diet should begin from postoperative day 2 to 4 regardless of the type of surgery [18]. In this study, the median duration of parenteral nutrition was 5 days. Meanwhile, 54.8% of patients received only

carbohydrates with or without composite amino acids postoperatively. No significant difference was found between malnourished and well-nourished groups in terms of duration. It might take some time before patients with malnutrition are properly stabilized. This study also supported the findings of previous studies that patients with malnutrition have a higher rate of overall postoperative complications [11, 19]. This indicated that elderly patients with malnutrition require close attention during the postoperative period, and nutritional support should be individualized for this vulnerable cohort.

Multivariate analysis showed that older age, longer duration of surgery, and postoperative complications were significantly associated with delayed discharge, which was consistent with previous studies [20]. This suggested that the length of surgery could be regarded as a reliable marker of surgical stress burden, and patients undergoing a long period of surgery need special care postoperatively.

To the best of our knowledge, this is the first study to assess the nutritional status and risk factors associated with delayed discharge among geriatric GC patients in China, using a large sample size. Due to its retrospective nature, this study has several limitations. The current study did not include long-term follow-up data, and the relationship between perioperative nutritional support and clinical outcomes among malnourished patients was not explored. Further large multicenter prospective randomized controlled trials should be conducted to validate our findings.

Conclusion

In conclusion, malnutrition is relatively common in elderly patients undergoing gastrectomy. Age, length of surgery, and postoperative complications are important risk factors associated with delayed discharge. Elderly GC patients with risk factors urgently require specific attention to reduce hospital stay.

Declarations

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Conflicts of interest: The authors declare that they have no competing interests.

Availability of data and material: All data and materials as well as software application or custom code supported our published claims and complied with field standards.

Code availability: Not available.

Authors contributions: Shengjin Ge and Xining Zhao operationalized the concept; data collection was done by Xining Zhao, Jie Liu and Ying Wang; Xining Zhao, Yuying Yang, and Yan Pan performed the analysis and interpretation of data; the manuscript was drafted by Xining Zhao. All authors approved the final manuscript.

Ethics approval: The study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of the Zhongshan Hospital Fudan University (B2021-392).

Consent to participate: We have got informed consent for publication from relevant participants.

Consent for publication: This journal is NOT associated with any Preprint publication services and regards the previous publication of any manuscript or study, in whole or in part, as resulting in a non-original manuscript submission to this journal.

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Tables

Table 1 Clinical and nutritional characteristics of malnourished and well-nourished elderly patients

item	Group	All (n=783)	Malnourished (n=249, 31.8%)	Well- nourished (n=534, 68.2%)	t/ χ^2 /F	P
Age, years	median(IQR)	70 (67, 74)	72 (69, 76)	69 (67, 73)	36.700	□ 0.001
Gender, n(%)	Male	584 (74.6)	184(74.9)	400(73.9)	0.092	0.762
	Female	199(25.4)	65(25.1)	134(26.1)		
BMI, kg/m ²		22.9 ± 3.4	19.4 ± 1.8	24.5 ± 2.6	-31.949	□ 0.001
Number of chronic diseases, n(%)	0~2	707(90.3)	221(88.8)	486(91.0)	0.986	0.321
	≥3	76(9.7)	28(11.2)	48(9.0)		
PNI		48.1 ± 5.6	48.8 ± 5.3	46.7 ± 5.7	-5.108	□ 0.001
Albumin(g/L)		40.2 ± 4.3	39.1 ± 4.6	40.7 ± 4.0	-4.680	□ 0.001
Prealbumin(mg/L)		207.8 ± 49.6	193.2 ± 50.6	214.6 ± 47.7	-5.709	□ 0.001
Hemoglobin(g/L)		121.0 ± 23.6	117.0 ± 24.1	122.8 ± 23.1	-3.205	0.001
Type of surgery, n(%)	Total gastrectomy	359(45.8)	112(45.0)	247(46.3)	0.653	0.721
	Distal gastrectomy	397(50.7)	130(52.2)	267(50.0)		
	Proximal gastrectomy	27(3.4)	7(2.8)	20(3.7)		
Operation time (min)	median(IQR)	160(123, 189.5)	160(123, 189)	160(129, 191)	3.025	0.082
Type of anesthesia, n(%)	General anesthesia	87(11.1)	35(14.1)	52(9.7)	3.206	0.073
	General anesthesia combined with epidural block	696(88.9)	214(85.9)	482(90.3)		
Preoperative consultation, n(%)	Yes	132(16.9)	47(18.9)	85(15.9)	1.060	0.303
	No	651(83.1)	202(81.1)	449(84.1)		
Preoperative	Yes	25(3.2)	9(3.6)	16(3.0)	0.210	0.647

neoadjuvant chemotherapy, n(%)	No	758(96.8)	240(96.4)	518(97.0)
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Abbreviations: BMI body mass index, PNI prognostic nutritional index

Table 2 Preoperative and postoperative nutritional support among elderly gastric cancer patients with or without malnutrition

		All (n=783)	Malnourished (n=249, 31.8%)	Well-nourished (n=534, 68.2%)	Z/ χ^2 /F	P
Preoperative nutrition, n (%)	Diet	359(45.9)	141(56.6)	218(40.8)	14.75	0.001
	Diet + single transfusion	373(47.6)	77(30.8)	296(55.4)		
	TPN	51(6.5)	31(12.4)	20(3.7)		
Postoperative nutrition, n (%)	Single transfusion	549(70.1)	194(77.9)	355(66.5)	10.592	0.001
	TNA	234(29.9)	55(22.1)	179(33.5)		
PN period	Median (IQR), day	5(4, 6)	5(4, 6)	5(4, 6)	0.004	0.951
EN period	Median (IQR), day	2(1, 2)	2(1, 3)	2(1, 2)	1.201	0.273
SSI grade	No, n (%)	669(85.4)	193(77.5)	476(89.1)	21.696	0.001
	I-II, n (%)	64(8.2)	27(10.8)	37(6.9)		
	III or higher, n (%)	50(6.4)	29(11.6)	21(3.9)		
In-hospital mortality	n	2	2	1		0.535
Re-admission within 30d	n	15	11	4		0.79
Length of hospital stay	Median (IQR), day	8(7, 10)	8(7, 9)	8(7, 10)	-1.504	0.133
Cost of hospitalization	Median (IQR), K¥	54.8(47.7, 64.7)	55.3(47.4, 66.6)	54.7(47.8, 63.2)	-1.051	0.293

Abbreviations: EN enteral nutrition, PN parenteral nutrition, TPN total parenteral nutrition, TNA total nutrient admixture, IQR interquartile range, SSI surgical site infection. SSIs were graded according to the Clavien-Dindo classification

Table 3 Univariate and multivariate analysis of clinical factors associated with prolonged length of stay

Clinical factors	Group	N=783	LOS	Univariate analysis		Multivariate analysis		
			(days)	χ^2	<i>p</i>	HR	95% CI	<i>P</i>
Sex	male	584	8(7, 10)					
	female	199	7(7, 9)	3.142	0.076	0.962	(0.817, 1.132)	0.637
Age, years	65~70	349	7(7, 9)					
	≥70	434	8(7, 10)	9.730	0.002	1.216	(1.048, 1.411)	0.010
Nutritonal status	Well-nourished	534	8(7, 9)					
	malnourished	249	8(7, 10)	2.245	0.134	0.990	(0.842, 1.163)	0.899
Surgery time, min	<180	438	7(7, 8)					
	≥180	345	8(7, 11)	44.218	□ 0.001	1.431	(1.237, 1.656)	□ 0.001
Anesthesia	GA	87	8(7, 11)					
	TEA	696	8(7, 9)	2.714	0.099	0.921	(0.734, 1.154)	0.474
Comorbidity	<3	707	8(7, 9)					
	≥3	76	8(7, 11)	3.915	0.048	1.067	(0.839, 1.357)	0.595
Hemoglobin, g/L	≥90	675	8(7, 9)					
	<90	108	8(7, 11)	1.893	0.169			
Albumin, g/L	>30	772	8(7, 9)					
	≤30	11	10(7, 11)	1.789	0.181			
Postoperative PN	Single transfusion	549	8(7, 10)					
	TNA	234	8(7, 9)	0.317	0.573			
PNI	≥48.5	396	8(7, 9)					
	<48.5	387	8(7, 9)	3.532	0.060	0.982	(0.849, 1.132)	0.807

			10)			1.136)	
Clavien-Dindo grade	0	669	8(7, 9)				□ 0.001
	1~2	64	10(7, 12)		2.191	(1.604, 2.991)	□ 0.001
	≥3	50	10(7, 17)	40.624	□ 0.001	1.163	(1.163, 1.701) 0.435

Abbreviations: LOS: length of stay; GA: general anesthesia; TEA: general anesthesia combined with thoracic epidural block; PN: parenteral nutrition; TNA: total nutrient admixture; PNI: prognostic nutritional index

Figures

Fig 1. Flowchart of the patient’s selection

Figure 1

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