

## ORIGINAL ARTICLE

# Investigation on nutritional risk assessment and nutritional support status of surgical patients with colorectal cancer

Yunlei Wang, Jianwei Zheng, Zhigang Gao, Xiaofeng Han, Fanrong Qiu

Department of General Surgery, Jingxi Campus of Beijing Chaoyang Hospital, Affiliated Capital Medical University, Beijing, China

## Summary

**Purpose:** To investigate the malnutrition, the incidence of nutritional risk and the application of nutritional support for patients with colorectal cancer, so as to provide a basis for the rational clinical application of nutritional support.

**Methods:** A total of 264 surgical patients with colorectal cancer treated/followed up from January 2016 to March 2017 in Beijing Chaoyang Hospital were selected. The nutritional risk was assessed using the Nutritional Risk Screening 2002 (NRS2002), and the nutritional risk and application of nutritional support for patients with different gender, age and clinical disease stage were analyzed; the hospitalization duration and postoperative complications were also analyzed and compared.

**Results:** According to NRS2002, malnutrition accounted for 6.06% and nutrition risk accounted for 79.55%. There was no statistically significant difference in the nutritional risk between patients with different gender ( $p=0.059$ ), the nutritional risk of the elderly patients ( $\geq 60$  years) was higher than that of the non-elderly patients ( $<60$  years) ( $p<0.001$ ), and the nutritional risk among patients with dif-

ferent clinical stages had no statistically significant difference ( $p=0.654$ ). All patients received nutritional support; the parenteral nutrition (PN) support rate was 39.02%, while PN+enteral nutrition (EN) support rate was 60.98%, while there was no patient receiving complete EN support. There was no statistically significant difference in the incidence rates of postoperative complications between patients with and without nutritional risk ( $p=0.546$ ), but there was a statistically significant difference in the hospitalization duration between patients with and without nutritional risk ( $p=0.019$ ).

**Conclusion:** The incidence rates of malnutrition and nutritional risk are high in patients with colorectal cancer and the incidence of nutritional risk is related to age. The application of NRS2002 in nutritional risk screening for patients with colorectal cancer can provide a reasonable and effective basis for the clinical nutritional support.

**Key words:** colorectal cancer, complications, NRS2002, nutritional risk, nutritional support

## Introduction

Among malignant diseases the incidence of colorectal cancer ranks third [1-3]. In China, colorectal cancer is one of the common digestive system malignancies, and with the aging in China, the prevalence and mortality rates of colorectal cancer have shown an increasing trend with age [4,5]. Cancer patients with malnutrition have a shortened survival, the treatment complications are increased and the quality of life is decreased. In

recent years, the nutritional status of patients with malignant tumors has attracted much attention.

Nutritional risk refers to the risk of adverse clinical outcome of patients caused by the existing or potential nutritional and metabolic factors, while whether the patient suffers from nutritional imbalance is not the ultimate goal, which is more closely related to the clinical outcome [6,7]. Nutrition Risk Screening 2002 (NRS2002) was sum-

marized by the Denmark Society of Parenteral & Enteral Nutrition via systematic evaluation of 128 randomized controlled trials (RCTs) published internationally, and it is also a tool for assessing the nutritional risk of inpatients recommended by the European Society Parenteral & Enteral Nutrition (ESPEN), as well as a screening tool recommended by the Society of Parenteral and Enteral Nutrition, Chinese Medical Association [8].

In this study, NRS2002 was used to analyze the incidence rate of nutritional risk in colorectal cancer patients from January 2016 to March 2017. At the same time, the nutritional risk in patients with different gender, age and clinical stage was compared, and the hospitalization duration and postoperative complications were also compared. Moreover, the application of nutritional support was surveyed, so as to provide a basis for the rational clinical application of nutritional support.

## Methods

### Patients

A total of 264 surgical patients with colorectal cancer treated in the Department of Gastrointestinal Surgery of Beijing Chaoyang Hospital from January 2016 to March 2017 were collected using the continuous fixed-point sampling, and followed up till discharge. Inclusion criteria: (1) patients aged  $\geq 18$  years; (2) patients with hospitalization duration of more than 5 days not subjected to emergency surgery within 24 hrs after admission; (3) patients who had conscious mind and could make verbal communication effectively; (4) patients with histopathologically confirmed colorectal cancer; (5) patients without receiving preoperative radiotherapy and chemotherapy; (6) patients without using albumin and/or immunopotentiator 2 weeks before operation; and (7) patients who signed written informed consent before the study. This study was approved by the ethics committee of Beijing Chaoyang Hospital.

Basic data were collected from patients meeting the inclusion criteria within 24 hrs after admission, and the changes in body weight over the past three months and the dietary status in the past two weeks were retrospectively surveyed. Nutritional risk screening was conducted via NRS2002 [8]. All patients were assessed by two trained physicians according to the uniform questionnaire and the same criteria. Nutritional risk among patients with different gender, age and clinical stage was analyzed, the hospitalization duration and postoperative complications were compared, and the clinical applications of different nutritional support methods were investigated.

### Evaluation criteria for malnutrition

The so-called malnutrition refers to the imbalanced nutrition (namely the insufficiency or excessive consumption of protein - calorie intake), which is often assessed via the body mass index (BMI), namely: (1) mal-

nutrition (insufficiency):  $BMI < 18.5 \text{ kg/m}^2$ ; (2) normal weight:  $18.5 \text{ kg/m}^2 \leq BMI < 24 \text{ kg/m}^2$ ; (3) overweight:  $24 \text{ kg/m}^2 \leq BMI < 28 \text{ kg/m}^2$ ; (4) obesity:  $BMI \geq 28 \text{ kg/m}^2$ .

### Scoring criteria of nutritional risk screening (NRS)

NRS2002 score = nutritional status score (0-3 points) + disease severity score (0-3 points) + age score (0-1 point); with a total score  $< 3$  points: patients do not have nutritional risk, and no nutritional support should be provided, or it may lead to adverse clinical outcome, and the NRS can be performed again regularly; with a total score  $\geq 3$  points: patients have nutritional risk, and nutritional support should be provided.

### Nutritional support program

Nutritional support was checked and put into the database 2 weeks after the operation or within 24 hrs after discharge, including PN, EN and PN+EN. According to the American Gastroenterological Association (AGA), PN is defined as the administration of two or more nutrients, including fat, amino acids and glucose, via peripheral or central veins; the non-protein heat  $\geq 41.84 \text{ kJ}/(\text{kg}\cdot\text{d})$  can be maintained for at least 3 days; EN is defined as the nasal or oral supplement of EN preparations, and the energy  $\geq 41.84 \text{ kJ}/(\text{kg}\cdot\text{d})$  can be kept for at least 3 days.

### Statistics

All statistics were performed using the Statistical Package for Social Sciences (SPSS) 20.0 software. Kruskal-Wallis test was used to determine whether the variable conformed to normal distribution. Student's t test and analysis by one-way ANOVA were performed for the normally distributed continuous variables, and chi-square test for categorical variables.  $p < 0.05$  suggested that the difference was statistically significant.

## Results

### Basic characteristics

A total of 264 surgical patients with colorectal cancer were enrolled into this study, completed the NRS and followed up till discharge. There were 188 males (71.21%) aged  $58.92 \pm 11.87$  years on average, and 76 females (28.79%) aged  $58.04 \pm 10.13$  years on average. There was no statistically significant difference in the age between patients with different genders ( $t = 0.431$ ,  $p = 0.712$ ).

### Incidence rates of malnutrition (insufficiency), normal nutrition, overweight and obesity

According to BMI, the patients with malnutrition (insufficiency) accounted for 6.06%, normal nutrition for 48.11%, overweight for 36.36% and obesity for 9.47%. There was a statistically significant difference in the malnutrition (insufficiency) between patients with different genders (3.72 vs 11.84%,  $\chi^2 = 4.945$ ,  $p = 0.016$ ) (Table 1).

*NRS2002 scoring results*

The patients with NRS2002 score of 2 points accounted for 20.45%, 3 points for 32.20%, 4 points for 22.35%, 5 points for 18.94% and 6 points for 6.06% (Table 2).

*Incidence rate of nutritional risk*

The patients with malnutrition accounted for 6.06%, and nutritional risk for 79.55%. No statistically significant difference was noted in the nutritional risk between male and female patients (82.45 vs 72.37%,  $\chi^2=4.126$ ,  $p=0.059$ ) (Table 3). However, a statistically significant difference was noted in the nutritional risk between the elderly patients ( $\geq 60$  years) and the non-elderly patients ( $< 60$  years)

(90.62 vs 69.12%,  $\chi^2=11.282$ ,  $p<0.001$ ) (Table 3). Moreover, all of 16 patients with malnutrition and 192 out of 247 subjects without malnutrition had nutritional risk which was statistically significant (100.0 vs 77.73%,  $\chi^2=2.984$ ,  $p=0.047$ ) (Table 3). There was no statistically significant difference in the nutritional risk among patients with different clinical stages ( $\chi^2=1.358$ ,  $p=0.654$ ) (Table 3).

*Applications of different nutritional support methods*

All of the 264 patients enrolled in this study were treated with nutritional support. The PN support rate was 39.02%, while the PN+EN support rate was 60.98%, and, of note, there was no patient receiving the complete EN support.

**Table 1.** Incidence rates of malnutrition (insufficiency), normal nutrition, overweight and obesity in different gender subgroups

Gender	BMI stratification, n (%)				$\chi^2$	Sum	p
	Malnutrition	Normal nutrition	Overweight	Obesity			
Male	7 (3.72)	90 (47.87)	77 (40.96)	14 (7.45)	4.945	188	0.016
Female	9 (11.84)	37 (48.68)	19 (25.00)	11 (14.47)			
Sum	16 (6.06)	127 (48.11)	96 (36.36)	25 (9.47)			

BMI: body mass index.

Note: BMI stratification: (a) malnutrition (insufficiency):  $BMI < 18.5 \text{ kg/m}^2$ ; (b) normal weight:  $18.5 \text{ kg/m}^2 \leq BMI < 24 \text{ kg/m}^2$ ; (c) overweight:  $24 \text{ kg/m}^2 \leq BMI < 28 \text{ kg/m}^2$ ; (d) obesity:  $BMI \geq 28 \text{ kg/m}^2$

**Table 2.** Nutritional risk score of NRS2002

Score	NRS2002						Sum
	2	3	4	5	6	7	
n	54	85	59	50	16	0	218
%	20.45	32.20	22.35	18.94	6.06	0	100

NRS2002: Nutritional Risk Screening 2002.

Note: NRS2002 score= nutritional status score (0-3 points) + disease severity score (0-3 points) + age score (0-1 point)

**Table 3.** Incidence rate of nutritional risk in different subgroups

Subgroups	n	Non-nutritional risk, n (%)	Nutritional risk, n (%)	$\chi^2$	p
Gender				4.126	0.059
Male	188	33 (17.55)	155 (82.45)		
Female	76	21 (27.63)	55 (72.37)		
Age, years				11.282	<0.001
<60	236	42 (30.88)	94 (69.12)		
$\geq 60$	128	12 (9.38)	116 (90.62)		
Nutrition				2.984	0.047
Malnutrition	17	0(0)	17 (100.0)		
Non-malnutrition	247	55 (22.27)	192 (77.73)		
Tumor stage				1.358	0.654
I	48	8 (16.67)	40 (83.33)		
II	42	10 (23.81)	32 (76.19)		
III	148	29 (19.59)	119 (80.41)		
IV	26	8 (30.77)	18 (69.23)		

**Table 4.** Complications in patients with or without nutritional risk

	<i>n</i>	Non-complications <i>n</i> (%)	Complications <i>n</i> (%)	$\chi^2$	<i>p</i>
Non-nutritional risk	54	47 (87.04)	7 (12.96)	1.214	0.546
Nutritional risk	210	172 (81.90)	38 (18.10)		

**Table 5.** Duration of hospitalization in patients with or without nutritional risk

	Nutritional support	<i>n</i>	Hospitalization duration (days)	<i>t</i>	<i>p</i>
Non-nutritional risk	PN	16	23.44±5.63	0.176	0.439
	PN+EN	38	23.58±5.52		
Nutritional risk	PN	87	26.87±8.95	0.268	0.745
	PN+EN	123	26.65±8.58		

PN: parenteral nutrition, EN: enteral nutrition

#### *Complications in patients with or without nutritional risk*

The patients with postoperative complications (including gastrointestinal symptoms, infection and anastomotic fistula) accounted for 17.05%, while was no statistically significant difference in the incidence rates of complications between patients with and without nutritional risk (12.96 vs 18.10%,  $\chi^2=1.214$ ,  $p=0.546$ ) (Table 4).

#### *Hospitalization duration in patients with or without nutritional risk*

The average hospitalization time of patients without nutritional risk was 23.49±5.58 days, while that of patients with nutritional risk was 26.73±8.77 days ( $t=3.693$ ,  $p=0.017$ ). There was no statistically significant difference in the average hospitalization time among patients receiving different nutritional support methods in the no nutritional risk group ( $t=0.176$ ,  $p=0.439$ ); and there was no statistically significant difference in the average hospitalization time among patients receiving different nutritional support methods in the nutritional risk group, either ( $t=0.268$ ,  $p=0.745$ ) (Table 5).

## Discussion

The incidence rate of colorectal cancer in China's cities ranks third among the malignant tumors, accounting for 10.41%, only following lung cancer and gastric cancer; the vast majority of patients are aged above 40 years, it is more common in males and its onset age gradually shows a younger trend [4,5]. Malnutrition generally exists in tumor patients, and its incidence rate is different in different tumor sites, tumor stages and tumor types, among which the malnutrition risk of

gastrointestinal tumors is higher [7,9]. Colorectal cancer patients often have risk of malnutrition, and the necessary nutritional support for them can avoid the occurrence of complications and shorten the postoperative hospitalization time. But the nutritional status of colorectal cancer patients has not been reasonably and effectively assessed for a long time, and the nutritional risk has also been ignored.

In this study, NRS was performed in surgical patients with gastric cancer in the Gastrointestinal Surgery department of our hospital via NRS2002; the patients with malnutrition accounted for 6.06%, while the patients with nutritional risk accounted for 79.55%, mainly because BMI reflects the current nutritional status of patients, but NRS2002 scores the recent weight, appetite, specific disease, treatment and age, so some patients with BMI  $\geq 18.5\text{kg/m}^2$  but NRS score  $\geq 3$  points are considered to have nutritional risks and need the nutritional intervention [8,10]. In this study, the patients with NRS2002 score of 2 points accounted for 20.45%, 3 points for 32.20%, 4 points for 22.35%, 5 points for 18.94% and 6 points for 6.06%, respectively. The results suggested that the severity of nutritional risk in 210 patients was not exactly the same. Studies have shown that the preoperative nutritional support for patients with NRS2002 score  $\geq 5$  points can reduce the incidence rate of complications; there were no statistically significant differences in the incidence rate of complications and hospitalization time among patients with 3-4 points, indicating that NRS2002 score can provide a basis for the preoperative nutritional support.

The reports on the relationship between gender and the incidence rate of nutritional risk in



inpatients are not consistent. Pirlich et al. [11] surveyed and found that the malnutrition and nutritional risk are independent of gender [12]. However, Castel et al. [13] reported that the nutritional risk in males is lower than that in females. In this study, there was a statistically significant difference in the malnutrition between males and females (higher in females than males), but there was no statistically significant difference in the nutritional risk between patients with different genders. Considering the small number of cases and large difference in the proportion of male and female in this study, the results were not representative, so multi-center and larger-sample studies are needed. Elderly cancer patients are often complicated with insufficiency or excessive consumption of protein-calorie intake, but the nutritional risk is often underestimated only based on the clinical experience. The results of this study showed that the incidence rate of nutritional risk in the elderly patients ( $\geq 60$  years) was significantly higher than that in the non-elderly patients ( $< 60$  years). With the aging of population in China, medical staffs should also be concerned about the nutritional problems for the elderly patients, in addition to the prevention, diagnosis and treatment of diseases [5,7]. In this study, there was no statistically significant difference in the clinical stages between patients with and without nutritional risk; on the one hand, this indicated that the presence of nutritional risk cannot be determined simply based on the grade of differentiation of tumor in the treatment of disease; on the other hand, the sample size was small in this study, so the results might have errors and more samples are still needed for further sound conclusions.

PN and EN are widely used clinically, which makes the clinical nutritional support enter the age of applying indications and guidelines [14,15]. EN should be absorbed by the gastrointestinal tract with absorptive capacity, and it can be used alone or combined with PN to reduce the dosage of PN and complications. PN is only considered when the gastrointestinal function cannot be restored, and its ultimate purpose is to re-select EN in a certain case after a certain therapeutic effect is achieved. Studies have confirmed that the PN and EN sequential therapy and early combined application of PN and EN can benefit patients. In this study, the PN support rate was 39.02%, while the PN+EN support rate was 60.98%, and there was

no patient receiving the complete EN support, suggesting that the nutritional support methods in our department are irrational, and the EN application needs to be improved in colorectal cancer patients. Studies have pointed out that the postoperative complications in patients with nutritional risk are increased, and the hospitalization time is prolonged. There was no statistically significant difference in the incidence rates of postoperative complications between patients with and without nutritional risk, and the average hospitalization time of patients with nutritional risk was significantly prolonged compared with that of patients without nutritional risk.

Some shortcomings should be acknowledged in this study: a) There were many inclusion criteria, but single disease type and few cases, and some results might have errors; b) No long-term prognosis analysis was performed, so some results were not persuasive.

In the process of nutritional support, the clinicians have insufficient knowledge of nutritional risk, and the necessity of nutritional support, support methods, nutritional support time and amount are mostly based on personal experience. Therefore, it is necessary to strengthen the universal education of nutritional knowledge, raise the awareness of nutritional risk, correctly assess the nutritional status, and develop reasonable and personalized nutritional support programs, thus benefiting the patients.

## Conclusions

The incidence rate of malnutrition in inpatients with colorectal cancer is high, and that of nutritional risk is higher, so the clinicians should pay attention to it and the timely and reasonable nutritional support should also be given. The incidence rate of nutritional risk in the elderly patients is higher than that in the non-elderly patients, suggesting that medical staffs should be concerned about the nutritional problems of the elderly patients in the diagnosis and treatment of diseases. Moreover, NRS2002 results can be used as a basis for the rational regulation of clinical nutritional support.

## Conflict of interests

The authors declare no conflict of interests.

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