Effects of nutritional and psychological status in gastrointestinal cancer patients on tolerance of treatment

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Abstract

AIM: To assess the effects of poor nutritional and psychological status on tolerance of cancer treatment and the recovery of physical performance status in patients with gastrointestinal cancer.

METHODS: An epidemiological survey with respect to nutritional and psychological status in patients with gastrointestinal cancer was conducted among 182 operated patients in four provincial-level hospitals from December 2005 to June 2006. The food frequency survey method, state-trait anxiety inventory (STAI) and depression status inventory (DSI) were used to obtain information about the diet and psychological status in the patients. Nutritional status in the participants was reflected by serum albumin (Alb), hemoglobin (HB) and body mass index (BMI).

RESULTS: Alb, protein intake and anxiety were associated with the severity of side effects of treatment. The adjusted relative risk (RR) for Alb, protein intake and anxiety was 3.30 (95% CI: 1.08, 10.10, P = 0.03), 3.25 (95% CI: 1.06, 9.90, P = 0.04) and 1.48 (95% CI: 1.29, 1.70, P < 0.0001), respectively. Moreover, calorie intake, HB and depression were associated with the recovery of physical performance status in the patients. Adjusted relative risk was 2.12 (95% CI: 1.09, 4.03, P = 0.028), 2.05 (95% CI: 1.08, 3.88, P =0.026) and 1.07 (95% CI: 1.02, 1.12, P = 0.007), respectively.

CONCLUSION: Both poor nutrition status and psychological status are independent risk factors for severe side effects of cancer treatment, and have impact on the recovery of physical performance status in patients after treatment.

INTRODUCTION

Chemotherapy and radiotherapy are the two important treatment modalities for cancer and can tumor cells and prolong survival time of cancer patients. Patients receiving high-dose chemotherapy need to be supported with parenteral nutrition[1]. Nutrition therapy can help cancer patients get the nutrients to maintain body weight and performance status, prevent body tissue from breaking down and rebuild tissues[2]. Malnutrition can make the patients have more severe chemotherapy-induced toxicity and complications[3]. High energy/protein diets help patients tolerate the treatment with fewer side-effects[4,5].

Besides nutrition, psychological status in the patients also impacts treatment outcome. Many cancer patients have psychological problems at different degrees[6]. Poor psychological status, such as depression or anxiety, not only affects the appetite of patients, but also increases side-effects of treatment[7] and impacts well-being of patients[3].

The effects of nutrition on cancer treatment have been studied by many authors[1-3]. However, few studies have reported on the association between nutritional and psychological status in the gastrointestinal cancer patients prior to chemotherapy/radiotherapy and treatment tolerance[4,6].

In this paper, we quantitatively analyzed the association between nutritional and psychological status in gastrointestinal cancer patients and treatment tolerance before treatment, and the effects of nutritional and psychological status in patients on physical performance status in the patients after treatment. We also analyzed the relation between nutritional status and psychological status in the patients. Our results may be useful for physicians to

improve the effect of cancer chemotherapy/radiotherapy and the quality of life of patients.

MATERIALS AND METHODS

Materials

Patients with esophagus, stomach, or colorectal cancer admitted to four provincial hospitals in Fuzhou, China, between December 2005 and June 2006 were enrolled in the study. The eligible patients were those who underwent surgical operations and were discharged 20 d before readmission to the hospitals. Patients who had to rely on parenteral nutrition support were excluded. There were 182 eligible participants in the study. After written consent was obtained, in-person interviews were performed for the participants with respect to information on nutrition and psychology status prior to chemotherapy/radiotherapy, side effects of cancer treatment during the treatment, and physical performance status after chemotherapy/radiotherapy. For each participant, the interview was conducted on the next day after admission. The interviewers were trained doctors and nurses in the hospitals. The study was approved by the Institutional Review Board for Human Research in the Fujian Province, China.

Of the 182 participants, 73 were esophagus cancer patients pre-surgery, 62 stomach cancer patients, and 47 colorectal cancer patients.

Methods

The food frequency survey method[8] was used to obtain information about the diet for each patient over the last week. The daily ten kinds of nutrition intake for each patient in the last week were calculated according to the food composition database[9]. On the basis of the reference values proposed by the Chinese Nutrition Society[9], the nutrition intake levels of the patients were evaluated. Daily calorie intake lower than 2400 kcal for male and 2100 kcal for female were defined as the low level of calorie intake, and daily protein intake lower than 70 g for male and 65 g for female were defined as the low level of protein intake.

State-trait anxiety inventory (STAI）and depression status inventory (DSI)[10] were used to measure psychological status of the participants. Each participant completed these two scales regarding his or her feeling at the time of interview. The patients were considered as suffering from anxiety when their STAI scores were higher than 55, and as suffering from depression when their DSI scores were higher than 40.

Nutritional status of the participants prior to chemotherapy/radiotherapy was reflected by serum albumin (Alb, g/L), hemoglobin (HB, g/L) and body mess index (BMI, BMI = weight/height^2, kg/m^2). Alb in the patient was regarded as deficient when his or her Alb was less than 35 (g/L). HB lower than 120 (g/L) for male and 110 (g/L) for female were defined as abnormal. According to the standard in East China, a person was considered suffering from malnutrition when his or her BMI was lower than 18 (http://whyuyu.vip.sina.com/news/new000540.htm).

We examined the side effects of chemotherapy/radiotherapy which occurred in the gastrointestinal system, respiratory system, liver and kidney, heart, hair, skin and nervous system. The severity of side effects in each system was scored as 1-5, respectively. The scores of side effects were given by the physician within 3-5 d after the start of their first cycle of chemotherapy. Each patient had a total score. The patient had a mild side effect of the treatment when his or her total score was less than 8, and a severe side effect when his or her total score was higher than 9.

When chemotherapy/radiotherapy was over, the nurses scored the physical performance status of the patients in terms of the physical activity status and capabilities of self-care. The score of physical performance status was from 1 to 5. In our analysis, the difference in physical performance status of the patients was determined by the score of physical performance status (score ≤ 2 for poor physical performance status and score > 2 for good physical performance status).

Multivariate logistic regression analysis was used to determine the association between nutritional and psychological status of the patients before and after chemotherapy/radiotherapy. Data were analyzed using SAS version 9.0 software (SAS Institute, Inc., Cary, North Carolina).

RESULTS

There were 55 females with a mean age of 54.3 years (SD = 11.56) and 127 males with a mean age of 55.3 years (SD = 10.96) in the study. The number of patients with stages Ⅰ-Ⅳ of the disease was 15 (8.24%), 27 (14.84%), 69 (37.%) and 71 (39.01%), respectively. Of the 182 patients, 57 (31.32%) had low education levels, 99 (54.39%) middle education levels, and 26 (14.29%) high education levels.

Stepwise logistic regression was used to select the risk factors for the treatment tolerance. At the significance level α = 0.05, Alb, protein intake and anxiety were associated with the severity of side effects of the treatment. The relative risk (*RR*) for Alb, protein intake and anxiety and 95% CI, adjusted for age, gender, stage of disease and tumor location, are shown in Table 1. The adjusted relative risk for Alb < 35 *versus* Alb ≥ 35 was 3.30 (*P* = 0.03) and 3.25 (*P* = 0.04) for inadequate protein intake *versus* adequate protein intake and 1.48 (*P* < 0.0001) for anxiety ≥ 55 *versus* anxiety < 55. The influence of low Alb on treatment tolerance was higher than that of the high anxiety score.

The association of nutritional and psychological status of the patients with their physical performance status after chemotherapy/radiotherapy was analyzed using stepwise logistic model. At the significance level α = 0.05, besides age, gender, stage of disease and tumor location, calorie intake, HB and depression were statistically significant in the model. Adjusted relative risk and 95% CI for these variables are shown in Table 2. Compared with the patients with high level of calorie intake, relative risk for the patients with low level of calorie intake was 2.12 (*P* = 0.028). The hazard of poor physical performance status among the patients with low level of HB was 2.05 times (*P* = 0.026) as high as that among those with normal levels of HB, and the hazard among the patients suffering from

Table 1 Relative risk of severe side effects of chemotherapy and 95% CI for nutrition and psychology factors

Risk factor	Mild side effect		Severe side effect		RR[1]	95% CI
	n	%	n	%		
Alb						
≥ 35	42	63.64	49	42.24	1.00	
< 35	24	36.36	67	57.76	3.30	1.08-10.10
Protein intake						
≥ 70 for male	51	77.27	70	60.34	1.00	
≥ 65 for female						
< 70 for male	15	22.73	46	39.66	3.25	1.06-9.90
< 65 for female						
Anxiety						
< 55	57	86.36	57	49.14	1.00	
≥ 55	9	13.64	59	50.86	1.48	1.29-1.70

[1]Relative risk adjusted for age, gender, stage of disease and tumor location.

Table 2 Relative risk of poor physical performance status and 95% CI for nutrition and psychology factors

Risk factor	Poor physical performance status		Good physical performance status		RR[1]	95% CI
	n	%	n	%		
Calorie intake						
≥ 2400 for male	57	50.44	48	69.57	1.00	
≥ 2100 for female						
< 2400 for male	56	49.56	21	30.43	2.12	1.09-4.13
< 2100 for female						
HB						
≥ 120 for male	50	44.25	37	53.62	1.00	
≥ 110 for female						
< 120 for male	63	55.75	32	46.38	2.05	1.08-3.88
< 110 for female						
Depression						
< 40	28	24.78	30	43.48	1.00	
≥ 40	85	75.22	39	56.52	1.07	1.02-1.12

[1]Relative risk adjusted for age, gender, stage of disease and tumor location.

Table 3 Relative risk of malnutrition for anxiety and 95% CI

	STAI score < 55		STAI score ≥ 55		RR[1]	95% CI
	n	%	n	%		
BMI						
< 18	37	56.06	29	43.94		
≥ 18	77	66.38	39	33.62		
					1.3	0.64-2.62
Alb						
≥ 35	63	69.23	28	30.77		
< 35	51	56.04	40	43.96		
					1.37	0.69-2.72

[1]Relative risk adjusted for age, gender, stage of disease and tumor location.

Table 4 Relative risk of malnutrition for depression and 95% CI

	DSI score < 40		DSI score ≥ 40		RR[1]	95% CI
	n	%	n	%		
BMI						
< 18	16	23.88	51	76.12		
≥ 18	41	35.65	74	63.35		
					1.58	0.73-3.40
Alb						
≥ 35	36	39.56	55	60.44		
< 35	22	24.18	69	75.82		
					1.76	0.86-3.63

[1]Relative risk adjusted for age, gender, stage of disease and tumor location.

depression was 1.07 times ($P = 0.007$) as high as that among those not suffering from depression.

The results suggested that nutritional status and psychological status might affect treatment tolerance and physical performance status of the patients. To examine the independent effects of nutritional status and psychological status, the adjusted relative risk of low BMI and Alb for both anxiety and depression was estimated (Table 3 and Table 4). The patients with anxiety had a higher risk of low BMI and Alb than those with no anxiety (RR = 1.30 and RR = 1.37, $P > 0.05$). Similarly, there was no association between depression and low BMI and Alb. These results suggested that both nutritional status and psychological status might be independent risk factors for severe side effects of the treatment and poor physical performance status of cancer patients.

DISCUSSION

This reports significant association of nutritional and psychological status with the treatment tolerance and the recovery of physical performance status in gastrointestinal cancer patients. Tumors are wasting diseases and many patients with tumors of the upper gastrointestinal tract have difficulty eating due to side effects of surgery. These patients are weak, tired, and unable to withstand cancer therapies because of malnutrition. The treatment outcome and prognosis of the diseases are associated with the nutritional status of the patients[11-13]. Chemotherapy-induced toxicity may be more severe in patients with pre-existing malnutrition[3]. Some studies indicate that high energy/protein diet can reduce side-effects of chemotherapy[4,5,11,14]. If the patients get enough calories and protein from their diet when they are not on chemotherapy or radiation therapy, they may have a better prognosis and are able to tolerate higher doses of chemotherapy or radiation therapy[15-17].

Khan et al[4] reported that pre-existing malnutrition in children with acute lymphoblastic leukaemia adversely affect the treatment outcome and decrease the response to chemotherapy. It was reported that decreased tolerance of chemotherapy is associated with poor clinical outcome of malnourished children[18,19]. However, Sikora et al[20] showed that no significant association was found between nutritional status and side effects of radiotherapy in 45 patients with esophagus cancer. In our study, the prevalence of severe side effects of chemotherapy/radiotherapy among the patients with low level of Alb was 3.30 times as high as that of those with normal Alb, suggesting that malnutrition does not help gastrointestinal cancer patients complete chemotherapy/radiotherapy.

A small amount of protein and calories results in low Alb. In our study, relative risk of severe side effects of the treatment for protein intake was 3.25, showing that protein intake has an independent effect on treatment

tolerance. Because the protein intake was not correlated with calorie intake, no statistical significance was found in the model ($r = 0.86$, $P < 0.0001$). Therefore, the patients who have not gotten enough calories and protein before chemotherapy may have severe side effects of chemotherapy or radiotherapy. Good appetite before cancer treatment may increase patients' energy and improve their sleeping, reducing the side effects of cancer treatment and improving their tolerance to higher doses of chemotherapy or radiotherapy. So, nutrition therapy is a promising, low cost, non-toxic and valid method for improving the outcome of cancer treatment.

Anxiety and depression are normal reactions to cancer. Patients experiencing chronic pain or body function damaged during surgery are at high risk of developing depression or anxiety. Studies showed that the presence of depression or anxiety has a detrimental effect on the recovery from cancer, response to cancer therapy and the death rate of cancer patients[21,22]. Depression burden significantly influences the severity of side effects of chemotherapy[23]. Intervention of psychology for the patients can decrease their anxiety symptoms and side effects of the treatment[24]. Our results also showed that the prevalence of severe side effects of the treatment in patients in good psychological status was lower than that in those with poor psychological status (adjusted RR = 1.48), and there was no association between poor psychological status and low BMI and Alb, suggesting that psychological status is an independent risk factor for cancer treatment tolerance in gastrointestinal cancer patients.

Usually, patients in poor physical performance status have a shorter survival time[25-27]. Protein and calories are important for providing energy and enhancing physical performance status. Our results showed that pre-existing poor nutrition status of the patients could affect their physical performance status after cancer treatment. Moreover, in our study, 77 (42.3%) patients had low calorie intake and 61 (33.5%) patients had low protein intake. Therefore, in order to promote clinical rehabilitation and improve survival, it is important to provide nutrition therapy and diet advice for the patients.

In the present study, we did not determine nutrition status and psychological status in the patients and study their relation before and after chemotherapy or radiotherapy. Moreover, since other variables reflecting nutritional status of the participants, such as serum pre-albumin, serum transferrin and arm muscle circumference, were not detected, the relative risk of poor nutrition status might be underestimated. Although there are some limitations in our study, our epidemiological survey still provides some important information about the association between side effects of chemotherapy/radiotherapy and nutritional and psychological status of the patients.

In summary, poor nutritional and psychological status are two independent risk factors for severe side effects of cancer treatment, which influence the recovery of physical performance status of the patients after treatment. After diagnosis and operation, the patients should be given diet guidance and mental therapy, which can decrease the severity of side effects of the next treatment and promote recovery of physical performance status and improve survival.

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