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ORIGINAL ARTICLE

A multicentre study to implement nutritional risk screening and evaluate clinical outcome and quality of life in patients with cancer

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BACKGROUND/OBJECTIVES: To implement nutritional risk screening and evaluate the relationship of nutritional risk to complication rate and quality of life in patients with cancer.
SUBJECTS/METHODS: A total of 687 patients with cancer from two teaching hospitals in China were consecutively enrolled. Data were collected on the nutritional risk screening, application of nutritional support, complication and quality of life.
RESULTS: The prevalence of nutritional risk at admission among the total, younger and elderly patients was 45.6%, 38.7% and 58.0%, respectively. There was a significant increase in the prevalence from admission to 2 weeks after admission in all patients ($P=0.011$). The prevalence in those patients $\geqslant$70 years was significantly higher than that in the younger ones ($P<0.001$). The highest prevalence of nutritional risk was in pancreas cancer (81.8%). Only 46.7% of at-risk patients received nutritional support and the average PN:EN ratio was 7.0:1. Complications were noted in 29.0% of all patients and were significantly more frequent in 'at-risk' patients ($P<0.001$). Among the scales of quality of life (SF-36), the scores of physical functioning ($P<0.001$), role-physical ($P<0.001$), bodily pain ($P=0.012$), energy/fatigue ($P<0.001$) and general health ($P<0.001$) were significant lower in the patients at risk.
CONCLUSIONS: A large proportion of cancer inpatients were at nutritional risk and tended to worsen during the course of admission, which has been associated with increased complication rate and lower scores of quality of life. The application of PN and EN was inappropriate in patients with cancer in China.

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Keywords: cancer; nutritional risk; nutritional support; complications; quality of life

INTRODUCTION

Undernutrition and nutritional risk are common problems in patients with cancer.[1] Some studies have reported that nutritional risk tends to worsen during the course of admission and has been associated with increased morbidity and mortality, prolonged hospital stay and increased health-care costs in the patients with cancer.[1,2] The value of nutritional support for patients with cancer is to improve the clinical outcomes.[3] Our multicenter prospective cohort study has showed that of the patients at nutritional risk, the complication rate was significantly lower in the nutritional-support group than in the no-support group, and multivariate analysis showed nutritional support was a protective factor for complications in at-risk patients when adjusted for confounders.[4]

The term nutritional risk is defined by the European Society for Clinical Nutrition and Metabolism (ESPEN) as 'chances of a better or worse outcome from disease or surgery according to actual or potential nutritional and metabolic status'[5] and nutritional screening as a 'rapid and simple process conducted by admitting staff or community health-care teams'.[6] Nutritional risk screening is an essential first step in the structured process of nutrition care for identifying cancer patients that will likely benefit from nutrition therapy,[7,8] but it is not routine in most hospitals in China.

The Nutritional Risk Screening (NRS-2002) is a tool developed by Kondrup and an ESPEN working group[5] in 2002, which is based on the outcome observed in controlled trials and identifies patients who are likely to benefit from nutritional support by an improved clinical outcome. It was designed to include measures of both current potential undernutrition and disease severity. After being validated with respect to clinical outcomes against 128 randomized controlled trials of nutritional support from the literature, the NRS-2002 was recommended by ESPEN for nutritional screening in hospitalized patients.[5,7] Study has shown that the NRS-2002 has a moderate sensitivity (62%) and high specificity (93%),[9] and that the NRS score predicts clinical outcomes.[6] However, there were no data of nutritional risk by NRS-2002 for patients with cancer in China when this study was carried out.

The main objective of the present study was to implement nutritional risk screening in patients with cancer, to investigate both the prevalence of nutritional risk and the application of nutritional support, and to evaluate changes in nutritional status during hospitalization from admission to discharge or over a 2-week period of hospitalization. The association between nutritional risk and clinical outcome was demonstrated in this study. The primary end points included complication rate and quality of life.

MATERIALS AND METHODS

Patients

From December 2011 to October 2012, adult cancer patients from wards of Gastrointestinal, Respiratory, Thoracic surgery and General surgery of

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Peking Union Medical College Hospital and Fifth Affiliated Hospital of Nanchang University were consecutively recruited if they met the following inclusion criteria: (1) age 18–80 years, (2) well oriented to time and place, (3) scheduled to stay at least one night in the hospital, (4) spoke/understood Chinese and (5) provided informed consent to participate in the study. Patients were excluded from the study if they were being admitted into an emergency department or had to be operated before the second morning of admission, or were not willing to give informed consent.

Protocol

This study was approved by the Peking Union Medical College Hospital (PUMCH) ethics committee (approval no S-054) and was registered in clinicaltrails.gov (NCT 00289380). The protocol was based on a study by Kondrup *et al*.[5] A research team was established in each center to collect all the information as follows: (1) some demographic data (age and gender) of the patients; (2) oncologic data (site of primary tumor, stage defined according to the International Union Against Cancer (UICC) classification and oncologic therapy); (3) the prevalence of nutritional risk by nutritional risk screening 2002 (NRS-2002); (4) application of nutritional support, which included types and contents of nutrition, for example, oral diet, enteral nutrition (EN), parenteral nutrition (PN); (5) complication rate; (6) quality of life investigated by using 36-item Short Form Health Survey (SF-36).[10] All measurements were made within 24–48 h of admission to hospital.

All patients were monitored daily until discharge. The medical record was reviewed within 24 h after discharge to verify all the information on the data collection checklist. If there was a difference in judgment of complications between the record on our checklist and the medical record, we talked with the attending physicians to make it clear.

The research protocol and the case report form (CRF) were designed in PUMCH. The original CRFs were kept in each research center, and all copies were sent to the Principal-Study-Center (PUMCH). Each CRF was double-checked by two independent investigators. During the whole study period, a group of supervisors controlled the development in each research unit.

The end points of the study were: (1) to define prevalence of nutritional risk in cancer patients and the changes in nutritional status during the hospitalization, and (2) to investigate the association of the nutritional risk with outcome, including complication rate and quality of life, in patients with cancer.

Nutritional risk screening and data collection procedure

The patients were interviewed within 24 h after admission for information on nutritional status and disease severity according to the items in the NRS-2002,[5] and the NRS score is calculated by adding the nutritional status impaired score (0–3) to the severity of disease score (0–3) plus a score of 1 for patients' age $\geqslant$70 years. The total NRS score ranges from 0 to 7. The nutritional status impaired score is determined by quartiles of decreased oral food intake in the previous week before admission, the presence of weight loss of at least 5% during the previous 1–3 months, and a low body mass index (BMI) combined the impaired general condition. In this study, we adapted Chinese BMI criteria (normal range $18.5 \leqslant BMI < 24.0$) established by Chinese Obese Working group, which is according to a population research.[11] The severity of disease was categorized as none, slight, moderate, or severe and converted to scores of 0–3. According to the recommendations by ESPEN Screening Guideline, an NRS score $\geqslant$3 means nutritionally at risk and a NRS score $<$3 means no nutritional risk.[5,7] After the first nutritional screening within 24 h after admission, the investigator continued to visit patients and measured those data until 2 weeks after admission or until the time of patient discharge.

Definition of parenteral nutrition (PN) and enteral nutrition (EN)

In this study, according to the guideline from ESPEN[12] and Chinese Society for Parenteral and Enteral Nutrition (CSPEN),[13] PN was defined as nutrients administered intravenously that contain a combination of amino acids, carbohydrate or fat with non-protein calories with at least 15 kcal/kg/day for at least 6 days. EN was defined as oral nutrient supplements and tube feeding, providing calories with at least 15 kcal/kg/day for at least 6 days.

Definition of infectious complications

Infectious complication was defined as the presence of recognized pathogens in body tissues that are normally sterile, confirmed by the results of culture, and supported by clinical, radiologic or hematologic evidence of infection, according to the definition by the American College of Chest Physicians/Society of Critical Care Medicine consensus conference.[14]

Quality of life and 36-item Short Form Health Survey (SF-36)

Quality of life was assessed employing the validated Medical Outcome Study 36-item Short Form General Health Survey (SF-36),[10] and scored according to Hays RD's criteria.[15] It is self-administered and assesses quality of life and well-being. The questionnaire of SF-36 consists of eight scales, which included physical functioning, role-physical, role-emotional, social functioning, emotional well-being, bodily pain, energy/fatigue and general health. Each scale ranges from 0 to 100, with a higher numerical score indicating better QOL or less impairment for that domain.[10]

Statistical analysis

All patients included in the study, once reviewed by our study group, were considered valid for the analyses.

Data were analyzed by double entering using the statistical software EPIDATA 3.0 by two investigators. Repeated comparisons between the two versions were made by statistical software until a definitive version of the final data was obtained. Statistical analysis was performed with SAS 9.1 (SAS Institute, Cary, NC, USA). Results were expressed as frequency, percentage, mean or median. Descriptive statistics were used to describe the frequency and percentage of patients able to complete the NRS-2002, the frequency of nutritional risk in patients, and the frequency of use of nutritional support. Categorical data were analyzed by the χ^2 test. The distribution of data was analyzed for normality. Analysis of variance (ANOVA) was used for the analysis of normally distributed numerical variables, Wilcoxon test for non-normally distributed numerical variables. Two-sided $P<0.05$ was chosen as the level of statistical significance. Results were considered statistically significant if $P<0.05$.

RESULTS

Participant flow and demographic data

Overall, 1285 cancer patients were admitted to the two centers during the whole period of this study, of whom 598 patients were excluded due to either not meeting the study criteria ($n=481$) or not willing to participate ($n=117$). A total of 687 consecutive cases who met the inclusion criteria upon admission were recruited into the study. Table 1 shows patient distribution according to demographic and disease characteristics.

The suitability of NRS-2002

The NRS-2002 was completed by 100% of the total sample ($n=687$). The staff carrying out the nutritional risk screening at admission included physicians (57%), nurses (22%) and dietitians (21%).

The prevalence and changes of nutritional risk during hospitalization

The prevalence of nutritional risk at admission among the total patients, younger patients and elderly patients was 45.6%, 38.7% and 58.0% respectively, and the results revealed a significant increase in the prevalence of nutritional risk from admission to 2 weeks after admission or discharge in all patients ($P=0.011$). When we divided patients by younger or elderly patients, only elderly patients demonstrated the same significant change ($P=0.024$), but no any difference was observed in the younger patients ($P=0.134$). The prevalence of nutritional risk in those patients $\geqslant$70 years was significantly higher than that of patients $<$70 years, both at admission ($P<0.001$) and at 2 weeks after admission or discharge ($P<0.001$). Detailed information concerning nutritional risk status is summarized in Table 2. The nutritional risk status at admission according to at-risk and not at-risk patients is shown in Table 3.

The prevalence of nutritional risk at admission and at 2-weeks after admission or discharge according to the different sites of primary tumors were summarized in Figure 1. Among the different kinds of cancers, the highest prevalence of nutritional risk at

Table 1. Patient demographics and distribution according to disease characteristics at admission

	n	%
Overall	687	100.0
Gender		
Male	433	63.0
Female	254	37.0
Age (range, years)	57.6 ± 13.5 (18–85)	
Younger patients (18–69 years)	444	64.6
Elderly (⩾70 years)	243	35.4
Site of primary tumor		
Lung	188	27.4
Esophagus	112	16.3
Stomach	97	14.1
Rectus	76	11.1
Colon	59	8.6
Liver	45	6.5
Breast	42	6.1
Cardiac	32	4.6
Pancreas	11	1.6
Others	25	3.6
UICC stages		
I	39	5.7
II	113	16.5
III	181	26.3
IV	354	51.5
Therapy		
Never treated	76	11.1
Past treated	106	15.4
Ongoing, one	359	52.3
Ongoing, two	119	17.3
Ongoing, three	27	3.9

Abbreviation: UICC, International Union Against Cancer.

Table 2. The prevalence of nutritional risk at admission and 2 weeks after admission or discharge

	n	*Nutritional risk*	
		Admission	*2 Weeks after admission or discharge*
Total	687	45.6% (313/687)	52.6% (361/687)[a]
Younger (18–69 years)	444	38.7% (172/444)	43.9% (195/444)
Elderly (⩾70 years)	243	58.0% (141/243)[b]	68.3% (166/243)[a,b]

[a]Compared with the data at admission, $P<0.05$. [b]Compared with the younger patients, $P<0.001$.

admission was in pancreas cancer (81.8%), while the lowest was observed in breast cancer (12.0%). Compared with the data at admission, the prevalence of nutritional risk at 2-weeks after admission or discharge increased among all kinds of cancer patients, and liver cancer patients demonstrated the significant change ($P=0.028$).

The prevalence of nutritional risk at admission and at 2-weeks after admission or discharge was significantly different between digestive and non-digestive tumors (Table 4), and the nutritional status, systemic and digestive symptoms in GI and non-GI cancer patients at admission were showed in Table 5.

Table 3. Nutritional risk status of newly admitted patients

	Not at risk	*At risk*	P-*value*
N	374	313	
Age (years)	57.1 ± 15.3	58.0 ± 11.9	0.601
Height (cm)	166.3 ± 8.9	165.1 ± 7.3	0.723
Body weight (kg)	66.4 ± 4.4	55.1 ± 3.9	<0.001
BMI (kg/m^2)	23.9 ± 2.8	19.5 ± 3.2	<0.001
Weight loss (kg)	6.2 ± 3.8	14.9 ± 7.9	<0.001
Nutritional impaired status (score 0–3)	0.3 ± 0.02	2.2 ± 0.1	<0.001
Severity of disease (score 0–3)	1.4 ± 0.1	1.5 ± 0.1	0.891
Total score	1.8 ± 0.02	3.8 ± 0.1	<0.001

Abbreviation: BMI, body mass index.

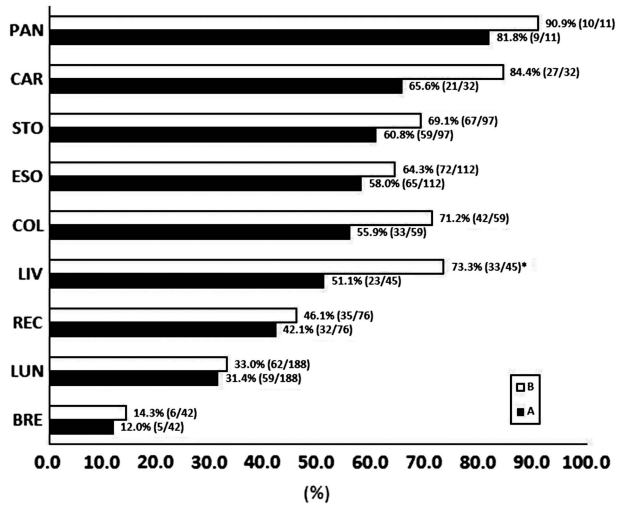

Figure 1. The prevalence of nutritional risk at admission and at 2 weeks after admission or discharge according to the different sites of primary tumors. A = at admission, B = 2 weeks after admission or discharge. PAN = pancreas, CAR = cardiac, STO = stomach, ESO = esophagus, COL = colon, LIV = liver, REC = rectus, LUN = lung, BRE = breast. *Compared with A, $P<0.05$.

Nutritional support in patients at risk or not at-risk screened by NRS-2002

In total, 34.9% (240/687) of patients was given nutritional support. The rates of parenteral nutrition (PN) and enteral nutrition (EN) were 30.6% (210/687) and 4.4% (30/687), respectively. The average ratio of PN and EN was 7.0:1.

Among the patients at risk (NRS⩾3), only 46.65% (146/313) received nutritional support. In contrast, 17.1% (64/374) of not at-risk patients (NRS<3) received nutritional support.

Difference in complication rate between patients at-risk and not at-risk

The details of complications and complication rates in the at-risk and not at-risk patients are presented in Table 6. Complications (including infectious and non-infectious complications) were noted in 29.0% (199/687) of the patients at admission. The rates were 24.6% (77 of 313) versus 13.1% (49 of 374) of infectious complications, 19.8% (62 of 313) versus 11.5% (43 of 374) of non-infectious complications and 38.9% (122 of 313) versus 20.6% (77 of 374) of total complications in 'at-risk' and not at-risk patients, respectively, and with significance difference ($P<0.001$, $P=0.003$ and $P<0.001$ respectively).

Table 4. The prevalence of nutritional risk at admission and two-weeks after admission or discharge according to digestive and non-digestive tumors

	n	*Nutritional risk*		
		Admission	*2 Weeks after admission or discharge*	P-*value*
Digestive tumors[a]	432	56.0% (242/432)	66.2% (286/432)	0.003
Non-digestive tumors[b]	230	27.8% (64/230)	29.6% (68/230)	0.757
P-value		<0.001	<0.001	

[a]Include: pancreas, cardiac, stomach, esophagus, colon, liver and rectus cancer. [b]Include: lung and breast cancer.

Table 5. Nutritional status, systemic and digestive symptoms in GI and non-GI cancer patients at admission

	GI (n = *432*)	*Non-GI* (n = *230*)	P-*value*
Weight loss > 5%, % (*N*)[a]	55.0 (237/432)	25.2 (58/230)	<0.001
Food intake < 75%, % (*N*)[b]	55.8 (241/432)	11.7 (27/230)	<0.001
Anorexia symptom, % (*N*)	59.5 (257/432)	14.4 (33/230)	<0.001
Nausea/vomiting, % (*N*)	44.4 (192/432)	10.4 (24/230)	<0.001
Early satiety, % (*N*)	46.5 (201/432)	17.8 (41/230)	<0.001
Diarrhea, % (*N*)	38.7 (167/432)	8.3 (19/230)	<0.001

Abbreviation: GI, gastrointestinal. [a]Percent and number of patients with weight loss of >5% of body weight within the 3 months prior to admission. [b]Percent and number of patients with dietary intake of <75% of requirement in the week prior to admission.

Quality of life score

Among eight scales of SF-36, the scores of physical functioning, role-physical, bodily pain, energy/fatigue and general health were significant lower in the patients at risk (Table 7).

DISCUSSION

Suitability of NRS-2002 in patients with cancer

There is no consensus among the experts upon the best way of screening the nutritional risk of cancer patients.[16] A large comparative study has shown that Nutritional Risk Screening 2002 (NRS-2002), a screening tool to detect nutritional risk in patients within the hospital setting, has a better performance than the malnutrition universal screening tool (MUST) and the nutrition risk index (NRI) compared with subjective global assessment (SGA).[9] Among all the screening tools, NRS-2002 was based on 128 randomized controlled clinical trials, which has been recommended by ESPEN.[7] Our study indicated that all the patients in Chinese teaching hospitals could complete the NRS-2002 screening process. The suitability rate reached 100% in this study. The result was congruent with that of a national survey conducted by our cooperative team in 2005–2008, which indicated that the screening tool can be completed by 99.2% of hospitalized patients among the east, west and middle areas in China.[13] Moreover, similar results were also shown in our previous comparative study between patients hospitalized in China and USA , which showed that completion rate of screening by using NRS-2002 reached to 94.0% of patients in Beijing and 99.5% of patients in Baltimore, respectively.[17] In our study, it took only a very short time (about 5–7min) to interview a patient and to complete the screening by a measuring staff who received and passed a training before this study. All the patients were very cooperative with the questions. As the NRS-2002 requires patients to report changes in their weight and food intake, only patients who were well-oriented in time and place were included in this study. This may have resulted in a selection that overestimated the suitability. Based on these findings, we agreed that the NRS-2002 tool could be considered one of the simple tools to screen hospitalized patients with cancer in China.

Table 6. Complications in 'at-risk' versus 'not at-risk' patients

	Not at risk	*At risk*
Infectious		
Pneumonia	14	23
Intraabdominal infection	17	26
Urinary tract infection	9	14
Wound infection	12	20
Gastrointestinal infection	12	17
Sepsis or bacteremia	2	6
Others	3	8
Non-infectious		
Gastrointestinal obstruction or perforation	7	13
Cardiac, renal or respiratory dysfunction	15	23
Gastrointestinal bleeding	6	11
Anastomosis leakage	7	13
Severe diarrhea	9	9
Pleural effusion or pneumatothorax	4	6
Severe diarrhea	8	8
Others	5	11

Table 7. Quality of life score (SF-36) in 'at-risk' versus 'not at risk' patients with cancer

	Not at risk (n = *374*)	*At risk* (n = *313*)	P-*value*
Physical functioning	64.0 ± 13.1	50.9 ± 14.1	<0.001
Role-physical	42.9 ± 23.4	29.9 ± 15.5	<0.001
Role-emotional	59.3 ± 19.1	57.4 ± 21.0	0.219
Social functioning	61.3 ± 19.3	58.7 ± 20.0	0.086
Emotional well-being	63.7 ± 20.4	60.8 ± 20.8	0.061
Bodily pain	36.2 ± 18.5	32.9 ± 16.2	0.012
Energy/fatigue	60.7 ± 20.7	48.0 ± 23.7	<0.001
General health	52.7 ± 23.8	33.6 ± 19.6	<0.001

The prevalence and changes in nutritional risk of patients with cancer during hospitalization

This study represents the first investigation using systematically the NRS-2002 to screen the nutritional risk of inpatients with cancer in China. To compare the results from other countries, we summarized 14 studies from Western countries (Table 8), which mostly used NRS-2002 or SGA or MUST as the screening tools. The prevalence of nutritional risk in hospitalized patients with cancer in our study was higher than that reported in those studies in European and American hospitals by using the same parameters.[3,6,18–29] It indicates that compared with cancer patients from European and American countries, there is a higher proportion of Chinese cancer patients at nutritional risk and with nutritional deficiencies at admission and during hospitalization. The possible reasons for this difference include: (1) compared with cancer patients in Western countries, the Chinese patients has relatively lower body weight and poor nutritional status at admission, and (2) relatively fewer doctors in Chinese hospitals can identify cancer patients at nutritional risk early in order to plan

Table 8. Comparison of the prevalence of nutritional risk and malnutrition in cancer patients from different countries

Authors/Countries	n	*Kinds of cancer*	*Tools*	*Key results*
Bozzetti F (2012), Italy[3]	1453	Heterogeneous	NRS-2002	At risk: 31.8% (462/1453)
Gavazzi C (2011), Italy[18]	100	Gastric	NRS-2002	At risk: 36.0% (36/100)
Norman K (2010), Germany[19]	189	Heterogeneous	SGA	Malnourished: 42.3% (80/189)
Norman K (2010), Germany[20]	399	Heterogeneous	SGA plus BMI	Moderate malnutrition 33.1% (132/399) Severely malnutrition: 25.1% (100/399)
Capuano G (2010), Italy[21]	61	Head and Neck	PG-SGA	Malnourished: 41.0% (25/61)
Pressoir M (2010), France[22]	1545	Heterogeneous	BMI, Wt loss	Malnutrition: 30.9%
Nourissat A (2008), France[23]	833	Heterogeneous	Weight loss	Malnourished: 31.3% (261/833)
Amaral TF (2008), Portugal[24]	130	Heterogeneous	MUST, NRS-2002 and MST	At risk: MUST: 43.8%, NRS-2002: 28.5%, MST: 17.7%
Sorensen J (2008), EU[6]	5051	Heterogeneous	NRS-2002	At nutritional risk: 32.6%
Gupta D (2006), USA[25]	58	GI	SGA	Malnourished: 41.4% (24/58)
Petruson KM (2005), Sweden[26]	49	Head and Neck	Weight loss	Malnourished: 41.0% (20/49)
Galvan (2004), Austria[27]	640	Heterogeneous	BMI, INS, PNRA, NRS	Moderate malnutrition: 9.0–54.8% Severe malnutrition:0.5–11.4%
Scott HR (2003), UK[28]	106	Lung	Weight loss	Malnutrition: 42.4% (45/106)
Isenring E (2003), Australia[29]	60	Heterogeneous	PG-SGA	Malnourished: 35.0% (21/60)

Abbreviations: BMI, body mass index; GI, gastrointestinal.

the best possible intervention, which make the patients' nutritional status tended to worsen during the hospitalization.

The results also showed that average prevalence of nutritional risk in patients with cancer was higher than that reported in general patients in Chinese and European. Kondrup *et al.*[30] reported that the prevalence of nutritional risk in general hospitals was 22%, which was similar with the national investigation for inpatients in China.[13] It indicated that disease-related nutritional risk occurs frequently in patients with cancer and might be a major cause of morbidity and mortality. Our study showed that the prevalence of nutritional risk was dependent on the different combination of the lengths of stay (LOS), site of primary tumor and age. Among the different sites of primary tumors, the highest prevalence of nutritional risk was found in the pancreas cancer patients and the lowest was in the breast cancer patients. Compared with the non-gastrointestinal cancer, the prevalence of nutritional risk in patients with gastrointestinal cancer increased significantly. A higher prevalence of nutritional risk was also observed in older aged cancer patients(age $\geqslant$ 70y), which was supported by our previous studies.[17] A significant increase in the prevalence of nutritional risk was found both in younger and elderly cancer patients during hospitalization from admission to 2 weeks after admission (or discharge) in this study. This result was consistent with the study conducted by Kondrup *et al*[30] in Denmark, using the same screening tool, who reported that 14 out of 740 patients developed a state of nutritional risk during their hospital stay.

We also analyzed the component data based on the NRS-2002 score categories, which includes the BMI, weight loss, nutritional impaired status score and severity of disease score according to at-risk and not at-risk patients (Table 2). The data indicate that low BMI and huge weight loss might be the most important contributors to nutrition risk in cancer patients in China.

Nutritional support application in patients with cancer

The results comparing the cancer patients at nutritional risk and the given nutritional support is also very meaningful. We found that only 46.7% (146/313) of the cancer patients at risk received nutritional support. On the other hand, 17.1% (64/374) of not at-risk patients (NRS $<$ 3) received nutritional support. It indicated that $>$50% cancer patients who were at nutritional risk have not received the necessary nutritional support, even if these patients without nutritional support have a relatively higher risk of complications and a higher mortality. The results from this study were consistent with studies conducted in China and in Europe. In China, a nationwide survey with a large number of patients from different medical specialties and hospitals demonstrated that only 32.7% patients at nutritional risk received nutritional support.[13] In Danish hospitals, one study showed that a nutrition plan was found in 14.2% of the records and 32.8% of patients at nutritional risk had a nutrition plan.[31] Another study carried out in 750 randomly selected patients found inadequate nutritional care in hospitals, and reported that only 25% of the patients at risk received an adequate amount of energy and protein.[30] Results from the Brazilian national survey showed that although there was a high prevalence of malnutrition (48.1%), only a small minority of patients (7.3%) were treated.[32] The data from the patients in USA showed that only 14.7% of patients who were at nutritional risk used parenteral and enteral nutrition during hospital stay.[17] In contrast, this study showed that 17.1% (64/374) of not at-risk patients (NRS $<$ 3) received nutritional support. This finding was also consistent with that of a multicenter nationwide investigation in China.[13] These results indicated clearly there was an imbalance between under- and overuse of nutritional support in cancer patients in China. There might be several possible reasons for inappropriate use of nutritional support, especially that clinical practice is not evidence-based or that nutritional support is of a low priority. It also could be that the assignment of responsibility for nutritional support is unclear or the institutions lack clinical procedures and guidelines regarding nutritional support.[30] To correct this situation should be a major goal in the future.

The average PN/EN ratio was about 7:1. It is significantly different from our previous survey that the PN/EN ratio was about 2:1 in teaching hospitals in the USA.[17] The overuse of PN has important implication on complication and costs. EN is often superior compared with PN, with lesser complications and lower costs. Therefore, it is absolutely necessary to increase the efforts to educate Chinese practitioners in using adequate nutritional support using evidence-based guidelines.

Quality of life for patients with cancer

Quality of life (QOL) for cancer patients is a subjective multi-dimensional construct that represents the patient's functional status, psychosocial well-being, health perceptions and disease or treatment-related symptoms.[33] Many studies showed that QoL is an extremely important outcome measure for cancer patients and correcting malnutrition may improve QoL in cancer patients. Cancer and treatment-induced changes in metabolism can lead to

alterations in physiological and psychological functions, which can reduce a patient's QoL by negatively influencing nutritional status.[34] A study systematically reviewed the relationship between nutritional status and QoL in cancer patients, which indicated that nutritional status is a strong predictor of QoL in cancer patients. With this study, we have demonstrated that among eight scales of SF-36, the scores of physical functioning, role-physical, bodily pain, energy/fatigue and general health were significant lower in the patients at risk.

CONCLUSIONS

The findings from this study provided evidence supporting that NRS-2002 was feasible as a nutritional risk screening tool used for patients with cancer in China. This study shows that a large population of cancer patients, about 45–52%, presents a nutritional risk at admission and at 2-weeks after admission or discharge, which has been associated with increased complication rate and lower scores of quality of life. It is necessary to create awareness among all medical professionals of the opportunity to identify cancer patients at nutritional risk early in order to plan the best possible intervention and follow-up during cancer treatment and progression. Further prospective studies are needed to confirm the effect of nutritional support on clinical outcomes and cost-effectiveness ratio in cancer patients at nutritional risk.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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