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Original Article

Application value of NRS2002 and PG-SGA in nutritional assessment for patients with cervical cancer surgery

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Abstract: Objective: This study explored and analyzed the application value of nutritional risk screening 2002 (NRS2002) and patient-generated subjective nutrition assessment (PG-SGA) in nutritional assessment for patients with cervical cancer surgery. Methods: A total of 165 cervical cancer patients that received elective cervical cancer surgery from February 2017 to December 2019 were chosen as the research subjects. NRS 2002 and PG-SGA were employed to evaluate the nutritional status of patients, and detect their nutrition-related laboratory examination indexes. By using albumin (ALB)≤30 g/L as the criterion of malnutrition, the accuracy of NRS2002 and PG-SGA in evaluating the nutritional status of patients was analyzed. Results: The differences between scores of NRS2002 and PG-SGA in age, BMI, tumor stage, pelvic lymph node metastasis were statistically significant (*P<0.05*); while the difference between scores of NRS2002 and PG-SGA in different education degree, pathological type and growth type of patients was statistically insignificant (*P>0.05*). By using ALB≤30 g/L as the gold standard to determine malnutrition, 64 malnourished patients were detected, with a detection rate of 38.79%. Compared with this gold standard, the judgment of NRS 2002 and PG-SGA have high consistency with the gold standard, and the Youden indexes were 0.550 and 0.795 respectively. In addition, the nutritional or malnutrition risk of cervical cancer patients was assessed by NRS2002 and PG-SGA, respectively. Among them, 33 patients received co-diagnosis, the results had remarkably correlation (*P<0.05*) with contingency coefficient r of 0.523. Conclusion: Both NRS2002 and PG-SGA are suitable for preoperative nutritional risk screening of patients with cervical cancer surgery. PG-SGA has a higher positive rate but poor time requirement than that of RS2002. Therefore, clinicians can choose the appropriate tool on the basis of an individual patient's situation for nutritional assessment.

Keywords: Nutritional risk screening 2002, patient-generated subjective nutrition assessment, cervical cancer, surgery, nutritional assessment

Introduction

Cervical cancer is one of the most common gynecological malignancies, which ranks first in female reproductive organ tumors. Patients with cervical cancer may have symptoms of vaginal bleeding and drainage, and in the late stage, symptoms such as swelling and pain of lower limbs, ureteral obstruction, and hydronephrosis may occur. For severe cases, uremia may also occur, causing systemic failure in patients and great harm to their life and health [1, 2]. The diagnosis rate of early cervical cancer has been improved with the development and popularization of clinical colposcopy and cytological examination, and surgery is the first choice in treating the disease [3]. For malignant tumor patients, about 32%-88% of them suffer from malnutrition, which is not conducive to their clinical outcome, and reduces the efficacy of anti-tumor treatment. Therefore, it is of great significance in improving the treatment effect and living quality of malignant tumors in patients by understanding their nutritional status as soon as possible and giving reasonable nutritional treatment [4, 5]. Currently, the nutri-

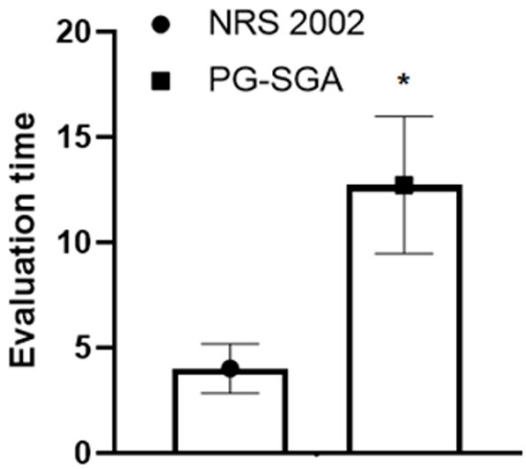

Figure 1. Comparison of NRS 2002 and PG-SGA evaluation times. Note: Compare with NRS 2002, *P<0.05.

tional assessment for inpatients in China is usually assessed by the nutritional risk screening tool 2002 (NRS2002). For tumor patients, the patient-generated subjective nutrition assessment (PG-SGA) has also been widely promoted and used in recent years [6, 7]. This study explored and analyzed the evaluation of NRS2002 and PG-SGA as screening tools on the nutritional status of patients undergoing cervical cancer surgery, which provided a theoretical basis for better improving the nutritional support. The report is as follows.

Materials and methods

Research subjects

A total of 165 cervical cancer patients that underwent elective cervical cancer surgery from February 2017 to December 2019 were chosen as the research subjects. The research was conducted under the approval of our hospital ethics committee.

Inclusive and exclusive criteria

Inclusive criteria: (1) The patient was diagnosed with cervical cancer by pathological examination; (2) The age of patients ranged from 30 to 70 years old; (3) Patients undergoing elective cervical cancer surgery; and (4) The patient had voluntarily signed informed consent.

Exclusive criteria: (1) Patients with recurrent tumors or combined with other malignant tumors; (2) Patients with severe heart, liver or kidney diseases; (3) Terminal patients, with an estimated survival time of less than 6 months; (4) Patients with mental disorders such as cognitive impairment; (5) Patients that received preoperative radiotherapy and chemotherapy; or (6) Patients who were not willing to participate in the survey.

Screening tools of nutritional risk

Patients were assessed for nutritional risk by NRS2002, recommended by the European Society for Parenteral Nutrition (ESPEN) [8]. The scale includes three parts: nutritional status score (0-3 points), disease severity score (0-3 points) and age score (0-1 points). A score of 0-2 indicates no nutritional risk, but the test should be repeated once a week. A score ≥3 indicates a nutritional risk and nutritional support is required.

The comprehensive subjective nutritional assessment of patients

The evaluation was conducted by PG-SGA. PG-SGA was developed on the basis of SGA. The modified version of scale, which was formulated by Professor Shi Hanping et al. according to Chinese patients with tumors, it includes two parts by patient self-assessment and medical staff assessment. The specific content includes 7 aspects of body weight, food intake, symptoms, activities and physical function, the relationship between disease and nutritional needs, metabolic needs and physical examination. The first 4 aspects are self-evaluated by patients (Section A, the score), and the last 3 aspects are completed by medical staff (Section B disease, Section C stress, and Section D physical examination score). The evaluation results can be divided into two types. The quantitative evaluation is directly described by the PG-SGA score, and the quantitative evaluation is divided into 4 levels of good nutrition (0-1 points), suspected malnutrition (2-3 points), and moderate malnutrition (4-8 points), severe malnutrition (≥9 points). With reference to the literature, PG-SGA score ≥ 4 is defined as malnutrition.

Investigation method

After the patients were admitted to the hospital, the NRS 2002 and the PG-SGA scale for

Table 1. Comparison of NRS2002 scores of patients with different clinicopathological characteristics

Clinicopathological features	Number of cases	NRS2002 scores	t/F	*P*
Age (years old)				
<40	39	1.84 ± 0.37	29.425	0.000
40~59	72	2.17 ± 0.32		
≥60	54	2.37 ± 0.31		
BMI (kg/m^2)				
<18.5	45	2.52 ± 0.39	12.212	0.000
≥18.5	120	1.93 ± 0.22		
Education degree				
Senior high school or below	68	2.08 ± 0.32	0.854	0.394
College degree or above	97	2.14 ± 0.41		
Pathological types				
Squamous cell carcinoma	104	2.19 ± 0.41	1.168	0.245
Adenocarcinoma	61	2.11 ± 0.37		
Tumor staging				
Phase I	53	1.68 ± 0.50	73.646	0.000
Phase II	78	2.26 ± 0.42		
Phase III	34	2.89 ± 0.47		
Pelvic lymph node				
Positive	41	2.75 ± 0.66	8.454	0.000
Negative	124	1.89 ± 0.53		
Growth type				
Endophytic growth	67	2.01 ± 0.39	2.271	0.107
Exophytic growth	79	2.20 ± 0.64		
Others	19	2.13 ± 0.52		

nutritional risk screening and nutritional status assessment were conducted by trained nutrition specialist nurse. At the same time, nutrition-related laboratory examination indicators were collected on admission of patients, including albumin (ALB), prealbumin (PA) and other relevant indicators. ALB≤30 g/L was used as the criteria for malnutrition.

Statistical analysis

Data processing and analysis were conducted statistical tool SPSS 22.0. *t*-test was used to compare the measurement data of the two methods. ANOVA was used to compare the counting data of the three and above, and the χ^2 test was used to compare the counting data. ALB≤30 g/L was used as the "gold standard" for the diagnosis of malnutrition to calculate the sensitivity and specificity of NRS2002 and PG-SGA scales for the diagnosis of malnutrition. *P<0.05* was considered statistically significant.

Results

Applicability of nutritional assessment

In the applicability survey, all the enrolled patients completed the NRS2002 and PG-SGA assessment, and the applicable rate was 100%. The average screening time of NRS2002 was (4.02 ± 1.17) min and that of PG-SGA was (12.73 ± 3.26) min. The duration of PG-SGA evaluation was critically longer than that of NRS2002 (t=32.303, *P< 0.05*) (**Figure 1**).

The evaluation results of NRS2002

NRS2002 was used to evaluate the nutritional risk of cervical cancer patients. Among them, 45 patients were under nutritional risk, with incidence of nutritional risk of 27.27%. The differences of NRS2002 scores in age, BMI, tumor stage, pelvic lymph node metastasis were statistically significant (*P<0.05*); while the difference of NRS2002 scores in education degree, pathological types and growth types of patients was insignificant (*P>0.05*) (**Table 1**).

Evaluation results of PG-SGA

PG-SGA was used to evaluate the nutritional risk of cervical cancer patients. Among them, 77 patients had nutritional risk, with an incidence of nutritional risk of 46.67%. The differences of PG-SGA scores in ages, BMI, tumor stage, pelvic lymph node metastasis were statistically significant (*P<0.05*); while the difference of PG-SGA scores in education degree, pathological types and growth types of patients was insignificant (*P>0.05*) (**Table 2**).

Comparison of evaluating accuracy between NRS 2002 and PG-SGA

By using ALB≤30 g/L as the gold standard to determine malnutrition, 44 malnourished patients were detected, with detection rate of

Table 2. Comparison of PG-SGA scores in patients with different clinicopathological characteristics

Clinicopathological features	Number of cases	PG-SGA scores	t/F	*P*
Age (years old)				
<40	39	3.59 ± 0.82	15.520	0.000
40~59	72	3.84 ± 0.69		
≥60	54	4.52 ± 1.07		
BMI (kg/m^2)				
<18.5	45	4.84 ± 1.25	4.720	0.000
≥18.5	120	3.76 ± 1.33		
Education degree				
Senior high school or below	68	3.96 ± 0.83	0.285	0.776
College degree or above	97	3.91 ± 1.27		
Pathological types				
Squamous cell carcinoma	104	3.85 ± 1.52	0.688	0.493
Adenocarcinoma	61	4.01 ± 1.30		
Tumor staging				
Phase I	53	3.54 ± 0.96	9.262	0.000
Phase II	78	4.02 ± 1.28		
Phase III	34	4.72 ± 1.54		
Pelvic lymph node			9.125	0.000
Positive	41	4.50 ± 0.79		
Negative	124	3.75 ± 0.27		
Growth type			0.557	0.574
Endophytic growth	67	3.79 ± 0.69	15.520	0.000
Exophytic growth	79	3.94 ± 0.94		
Others	19	3.84 ± 1.07		

26.67%. Compared with this gold standard, the judgment of NRS 2002 and PG-SGA have high consistency with the gold standard, and the Youden indexes were 0.550 and 0.795 respectively (**Table 3**).

The relevant assessment between NRS2002 and PG-SGA

The nutritional risk or malnutrition of cervical cancer patients was judged by NRS2002 and PG-SGA respectively. Among them, 33 patients received co-diagnosis, the results had remarkably correlation (*P<0.05*) with contingency coefficient r of 0.523 (**Table 4**).

Discussion

Patients with malignant tumors have a high risk of malnutrition, especially for those needing surgical treatment. The occurrence of malnutrition often indicates that the patients have insufficient immune function, which imposes a serious impact on the prognosis of patients [10, 11]. Therefore, judging the patient's nutritional status as early as possible and giving active and effective nutritional support can improve the patient's postoperative prognosis and reduce intraoperative and postoperative complications. It provides better body conditions for the development of non-postoperative radiotherapy and chemotherapy, and is of great significance in reducing the long-term recurrence and prolonging the survival time of patients [12-14].

NRS2002, which was developed by the Danish Parenteral Nutrition Association, is the first nutritional risk screening tool on the basis of 128 randomized controlled studies of evidence-based medicine. It is simple and easy to operate with good reliability [15]. Studies have applied NRS-2002 to the nutritional risk of Chinese inpatients and determine if nutritional support is needed for them, and the results have confirmed that NRS2002 is suitable to be used in Chinese hospitalized populations [16, 17]. It has the advantages of time-saving, convenient, and easy operation by medical staff, but the disadvantage is that its four core contents include a low-sensitivity indicator BMI. Therefore, this tool is suitable as a screening method for predicting the prognosis of nutrition and the effect of nutrition treatment, rather than the diagnosis of malnutrition in the true sense [18]. PG-SGA is primarily used for assessing the nutritional status of patients with malignant tumors, and the higher the score indicates the worse the nutritional status of patients [19]. Compared with NRS2002, PG-SGA is much more focused on the assessment of chronic nutritional changes, but the scale has a lot of content and complicated assessment operations, which causes certain difficulties in its specific implementation [20].

Table 3. Comparison of evaluating accuracy between NRS 2002 and PG-SGA

Tool	Classification	ALB		Sensitivity	Specificity	Yoden index
		Malnutrition	Normal nutrition			
NRS 2002	Nutritional risk	39	6	60.94	94.06	0.550
	Normal	25	95			
PG-SGA	Malnutrition	61	16	95.31	84.16	0.795
	Normal	3	85			

Table 4. Analysis of the relevance between NRS 2002 and PG-SGA judgment results

		NRS2002		χ^2	P	Contingency coefficient r
		With nutritional risk	No nutritional risk			
PG-SGA	Malnutrition	33	44	17.679	0.000	0.523
	Normal nutrition	12	76			

This study explored and analyzed the application value of NRS2002 and patient-generated PG-SGA in nutritional assessment for patients with cervical cancer surgery. The nutritional risk of patients with cervical cancer was evaluated by NRS2002. Among them, 45 patients had nutritional risk, with an incidence of nutritional risk of 27.27%; and when PG-SGA was used for assessment, there were 77 patients with malnutrition and the incidence of nutritional risk was 46.67%. The proportion of patients identified as having nutritional risk by NRS2002 was critically lower than that of the cases evaluated by PG-SGA, which is consistent with other literature reports [21, 22]. This may be related to the setting of NRS 2002 and PG-SGA scoring standards and the division of scores. PG-SGA has a higher detection rate as it comprehensively reflects the nutritional status of cervical cancer patients by evaluating their ingestion, symptoms, activities, body functions and metabolism. Studies have showed that both NRS2002 and PG-SGA are related to age, tumor stage and pelvic lymph node metastasis, and the two tools showed good consistency and significance to each other.

PG-SGA is developed from SGA. Its advantage is that most of the symptoms that are likely to affect the nutritional status of patients are included in the evaluation method, which has a high sensitivity and specificity [23, 24]. In this study, the sensitivity and specificity of PG-SGA were 95.31% and 84.16% respectively, which is basically consistent with the current findings. However, both NRS2002 and PG-SGA had high Yoden index, and the diagnosis results of the two were remarkably correlated, which similar to the results reported by scholars [25, 26]. This suggested that either NRS 2002 or PG-SGA can be used for nutritional assessment of patients undergoing cervical cancer surgery, and clinical workers can carry out corresponding nutritional support on basis of these assessment results.

Considering that the sample size included in the study is limited, and the different factors of treatment, research time, and that the researchers may impose certain effect on the research results; more experiments to further expand the sample size and control the influencing factors as much as possible in the follow-up study will occur in order to obtain more reliable clinical study results.

In summary, both NRS2002 and PG-SGA are suitable for preoperative nutritional risk screening of patients with cervical cancer surgery. PG-SGA has higher positive rate but worse time requirement than that of RS2002. Therefore, clinicians can choose the appropriate tool on basis of patient's situation for the nutritional assessment.

Disclosure of conflict of interest

None.

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