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Comparison of Tools for Nutrition Assessment in Queen Sirikit Heart Center of the Northeast, Thailand

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Abstract. *Objective:* This study was to determine the prevalence of malnutrition and compare 2 assessment tools- the NRI and SGA, and non-nutritional factors in hospitalized patients. *Methods*: This prospective study was done in the Queen Sirikit Heart Center (QHSC) of the Northeast, Thailand. 150 consecutive patients hospitalized were studied. On admission, SGA, NRI, age, BMI, anthropometric measurements, and laboratory data were assessed. *Results*: On admission, 38% of patients were malnourished according to the SGA and 42% according to the NRI. Malnutrition scores correlated significantly with age, % of weight loss, and LOS. BW, anthropometric data, albumin, LC, and TC correlated inversely with both techniques. Concordance was observed in 139 of the 150 (92.67%) patients with both assessments. Good level of agreement was achieved (κ = 0.426, P = 0.000). *Conclusions*: Both tests correlated with each other with respect to age, LOS, and anthropometric and laboratory data in hospitalized patients. Therefore, these two techniques can be used for nutritional assessment in QHSC patients.

Keywords: Subjective Global Assessment (SGA), Nutrition Risk Index (NRI), Body Mass Index (BMI)

1. Introduction

Malnutrition is a significant problem in hospitalized patients and is associated with increased rates of morbidity and mortality, cost, and hospital length of stay (LOS). [1]-[5] Thus, nutrition status should be evaluated in hospitalized patients. [6] Early diagnosis and treatment of malnutrition may prevent its negative effect on outcomes.

The prevalence of malnutrition varies from 20% to 50% in different studies according to the different criteria used. In Europe, Naber et al. [7] found malnutrition in 45% of internal medicine and gastrointestinal patients, and McWriter and Pennington [8] found malnutrition in 40% of patients. The Brazilian National Survey reported malnutrition in 48.1% of patients on admission. [9] In two recent studies from England, the prevalences of malnutrition in hospitalized patients at admission were 20% and 40%, respectively. [10], [11] Nutritional assessment is "a comprehensive approach to defining nutrition status that uses medical, nutrition, and medication histories; physical examination; anthropometric measurements, and laboratory data. Furthermore, it includes the organization and evaluation of information to declare a professional judgment." The goals of a formal nutrition assessment are to identify patients who are malnourished or are at risk for malnutrition; to collect the information necessary to create a nutrition care plan; and to monitor the adequacy of nutrition therapy. [12] There is no agreement as to which index best reflects nutritional status in hospitalized patients. Indicators such as significant weight loss over time, significantly low or high weight or body mass index, reduction in mid-arm circumference, and skin fold thickness have been used to determine nutritional risk. The Nutrition Risk Index (NRI), used in the Veterans Administration Cooperative Group study of perioperative parenteral nutrition, successfully stratifies operative morbidity and mortality using serum albumin and the ratio of current weight to usual weight. [13] The only clinical method that has been

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validated as reproducible and that evaluates nutritional status (and severity of illness) by encompassing the patient's history and physical parameters is the Subjective Global Assessment (SGA). [14], [15] The main objectives of this study were to assess patients' nutritional status and to assess the degree of concordance between the SGA and the NRI.

2. Materials and Methods

This prospective study was done in the Queen Sirikit Heart Center in the Northeast of Thailand, Faculty of Medicine, KhonKaen University. Thailand. One hundred and fifty consecutive patients hospitalized in medical and surgical wards were studied. We assessed nutritional status and laboratory parameters in patients on admission. Hospital patients had to be 18 yr. or older to be eligible. Obstetric and pediatric patients and comatose patients without relatives or friends were excluded.

2.1. Nutritional Measurements

Two methods were applied for nutritional assessment. The SGA provides a systematic method of obtaining a nutritional history and physical examination and applying clinical judgment to rate a patient's nutritional status. The reliability and validity of the SGA are well established. [16], [17] The SGA was performed using a questionnaire that incorporates the patient's history (weight loss, changes in dietary intake, gastrointestinal symptoms, and functional capacity), physical examination (muscle, subcutaneous fat, sacral and ankle edema, ascites), and the clinician's overall judgment of the patient's status (A, well-nourished; B, suspected malnourished or moderately malnourished; C, severely malnourished). [18], [19] An SGA score of B or C was classified as malnutrition. The NRI is a simple equation that uses serum albumin and recent weight loss:

$$\text{NRI} = (1.519 \times \text{serum albumin [g/L]}) + 0.417 \times (\text{present weight/usual weight} \times 100) \qquad (1)$$

An NRI score higher than 100 indicates that the patient is not malnourished, a score of 97.5 to 100 indicates mild malnutrition, a score of 83.5 to 97.5 indicates moderate malnutrition, and a score lower than 83.5 indicates severe malnutrition. [13] Height was recorded from case notes when available or measured with a stadiometer. Weight was measured with mechanical scales or bathroom scales. Height and weight were used to determine body mass index (weight [kg]/height [m^2]). Triceps skinfold thickness was measured with a skin caliper on the posterior upper arm, midway between the acromion and olecranon process. [20] A skinfold thickness of 4 to 8 mm was classified as borderline fat stores, and a thickness of 3 mm or less as severe depletion. Mid-arm circumference was measured with a non-stretch measuring tape, midway between the acromion and olecranon of the non-dominant arm; 15 cm or smaller was considered an indicator of severe depletion of muscle mass. Mid-arm circumference and triceps skinfold thickness were used to calculate mid-arm muscle circumference according to the formula,

$$\text{mid-arm muscle circumference (cm)} = \text{mid-arm circumference (cm)} - (\text{triceps skinfold thickness [mm]} \times 0.3412) \qquad (2)$$

As an estimate of muscle mass or lean tissue stores. [21] A fasting blood sample was obtained to measure complete blood count, albumin, total protein and total cholesterol (TC) . The lymphocyte count (LC) was calculated from the total blood cell count, and the differential white blood cell count was obtained by an automated analyzer.

2.2. Statistical Methods

The data were analyzed with SPSS 10.0 for Windows (Chicago, IL, USA). Differences between independent groups were assessed with Student's *t* test and one-way analysis of variance. Spearman's rank correlation coefficients were calculated for association between scores and variables. Data are presented as mean ± standard deviation. Differences were considered to be statistically significant at $P < 0.05$. Agreement between the two assessment methods was analyzed by the κ statistic. The value of κ varies from 0 to 1; a value of 0.4 or less indicates that chance alone can account for the observed agreement, and a value of 1 indicates perfect concordance.

3. Results

During the 3-mo study period, 150 patients were assessed within 24 hr. after hospital admission. The overall prevalence of malnutrition was 38% as determined by combining the two categories of malnutrition according to the SGA (moderately and severely malnourished). The frequency of any degree of malnutrition at admission was 42% according to the NRI (mild, moderate, and severe malnutrition). Malnourished patients were older than well-nourished patients with both assessments (P = 0.000). Body weight, body weight loss, albumin, lymphocyte count, total cholesterol, and length of hospital stay differed between malnourished and well-nourished groups according to both assessments. Anthropometric data were lower in the malnourished groups according to both techniques (Table I).

Malnutrition scores correlated significantly with age, percentage of weight loss, and length of hospital stay. Body weight, anthropometric data, albumin, lymphocyte count, and total cholesterol correlated inversely with both techniques (Table II). Concordance was observed in 139 of the 150 (92.67%) patients with both assessments. Good level of agreement was achieved (κ = 0.426, P = 0.000; Table III).

Table I: Patient characteristics and anthropometric and laboratory data by nutritional status.

Characteristic	Subjective Global Assessment			Nutrition Risk Index		
	Well nourished* (n=93)	Malnourished* (n= 57)	P**	Well nourished* (n=87)	Malnourished* (n=63)	P**
Age (y)	42.19 ±1.3	67.0 ±0.9	0.000	42.03 ±1.7	68.3 ±1.5	0.001
Weight (kg)	66.4 ±1.4	50.2 ±0.2	0.000	64.1 ±3.5	49.7 ±1.1	0.000
Weight loss (%)	0.9 ±0.8	10.2 ±1.5	0.000	1.1 ±0.2	8.3 ±0.3	0.000
TSF (mm)	17.8 ±3.1	21.3 ±2.8	0.000	18.1 ±1.2	25.5 ±2.7	0.001
MAMC (cm)	18.7 ±0.8	15.2 ±3.5	0.000	17.5 ±0.6	16.9 ±0.8	0.012
BMI (kg/m^2)	24.4 ±0.3	18.3 ±3.7	0.000	23.5 ±1.3	18.2 ±1.7	0.000
Albumin (g/dL)	4.2 ±0.6	3.5 ±0.6	0.000	4.4 ±0.3	3.3 ±0.5	0.001
Lymphocyte count	2, 359 ±642	1,795 ±327	0.003	2,670 ±238	2,235 ±364	0.023
Total cholesterol	179.9 ±1.7	142.7.0 ±4.9	0.000	185.3 ±0.3	144.2 ±0.1	0.000
Length of hospital stay	8.2 ±0.1	18.3 ±1.8	0.000	9.4 ±1.3	19.0 ±1.6	0.000

* Malnourished versus well-nourished patients with the same assessment.
** Mean _ standard deviation.
BMI, body mass index; MAMC, mid-arm muscle circumference; TSF, triceps skinfold.

Table II: Correlation coefficient and P value between patient data and nutritional assessment techniques.

Characteristic	Subjective Global Assessment		Nutrition Risk Index	
	r	P	r	P
Age (y)	0.264	0.000	0.291	0.000
Weight (kg)	-0.681	0.000	-0.522	0.000
Weight loss (%)	0.884	0.000	0.749	0.000
TSF (mm)	-0.398	0.000	-0.422	0.000
MAMC (cm)	-0.329	0.000	-0.257	0.000
BMI (kg/m^2)	-0.551	0.000	-0.398	0.000
Albumin (g/dL)	-0.603	0.000	-0.517	0.000
Lymphocyte count	-0.211	0.000	-0.199	0.011
Total cholesterol	-0.351	0.000	-0.485	0.000
Length of hospital stay	0.447	0.000	0.368	0.000

BMI, body mass index; MAMC, mid-arm muscle circumference; TSF, triceps skinfold.

Table III: Patient's nutritional status according to both techniques.

Subjective Global Assessment	Nutrition Risk Index		Total
	Well nourished*	Malnourished*	
Well nourished*	75	18	93
Malnourished*	12	45	57
Total	87	63	150

*κ = 0.426, P = 0.000.

4. Discussion

In this study, we found that the overall prevalence of malnutrition was 38% according to the SGA and 42% according to the NRI. With regard to the two assessment techniques, body weight, albumin, lymphocyte count, total cholesterol, and anthropometric data were lower in the malnourished groups. In addition, nutritional status correlated inversely with body weight, anthropometric data,albumin, lymphocyte count, and total cholesterol. A good degree of inter-assessment agreement was found.

Malnutrition in hospitalized patients is a critical issue and has been associated with a significant increase in morbidity and mortality. [7], [22], [23] Worldwide studies have indicated that between 20% and 50% of hospitalized patients have some degree of malnutrition. [8]-[11] Our malnutrition rates are consistent with those in the literature.

Nutrition screening identifies individuals who are malnourished or are at risk for malnutrition. The purpose of the nutritional screening is to determine whether a more detailed nutritional assessment is necessary. Objective and subjective data can facilitate early intervention and assist initiation of a formal nutrition intervention or supplementation. [12] No single nutritional measurement can be considered 100% sensitive and specific because non-nutritional responses to illness affect many nutrition indicators. A history of weight loss can be one of the most important pieces of information in the nutrition screening and assessment process. Involuntary weight loss is an ominous sign and should be investigated. Weight loss greater than 5% in 1 mo or 10% in 6 mo can be considered clinically significant. Weight loss greater than 10% in 6 mo and physiologic impairment of two organ systems

can lead to major complications, sepsis, and pneumonia. [24] The SGA uses physical findings and four areas of medical history: change in weight over the past 2 wk and 6 mo, change in dietary intake, gastrointestinal symptoms, and functional capacity. It is used primarily by clinicians to assess nutritional status in hospitalized patients. [15] This technique has good inter-rater agreement, has good sensitivity and specificity, [17] and predicts nutrition-related complications in certain populations, including surgical patients. [7], [16] Some have reported the high correlation between the SGA and other measures of nutritional status assessments that are felt to be perhaps more objective such as anthropometry, albumin, total serum protein, and criterion standard measures of body composition. [14], [25] Consistent with the literature, our results showed good correlation between the SGA and objective assessments such as anthropometry, albumin, total cholesterol, weight, and weight loss.

Albumin is commonly thought of as a good marker of nutritional status and visceral protein stores. Studies have demonstrated that low serum albumin concentrations correlate with longer hospital stay, medical complications, and increased mortality. [26], [27] The NRI is derived from the serum albumin concentration and the ratio of actual to usual weight with the equation. The malnutrition rate was reported in 56% of non-surgical patients assessed by the NRI technique, [7] whereas the prevalence of the malnutrition rate was 42% of all hospitalized patients in our study. The reason for this difference of malnutrition rate was due to different patient populations. We studied all patients including surgical and medical patients. In this study, good correlations were found between the NRI and objective assessments.

Covinsky et al. [28] reported that patients with higher albumin concentrations are more likely to be rated as well nourished and that patients with low albumin concentrations are more likely to be rated as malnourished on clinical examination. Persson et al. [29] found that the SGA, the Mini-Nutritional Assessment, and the Short Mini-Nutritional Assessment correlated strongly with each other, but none of these techniques correlated with albumin. In our study, the SGA and the NRI correlated with each other (r = 0.788) and with the anthropometric and laboratory data. Both tests also had good concordance (κ = 0.426, P = 0.000).

Clinical judgment correlated well with four commonly objective parameters, namely weight loss, albumin, transferrin, and cholesterol. Basically, we can say that the SGA is a clinical assessment and that the NRI is an objective test. In addition, clinical assessment and objective tests correlated with each other, and these tests showed good concordance in hospitalized patients in our study.

The SGA has some limitations as a measure of nutritional status, and some of these limitations probably also accounted for the concordance level between the NRI and SGA ratings. First, the SGA was designed to enhance specificity at the expense of sensitivity.[18] Second, the SGA does not allow for the categorization of mild malnutrition. Third, the SGA focuses on chronic instead of acute nutritional changes. As a result of these three limitations, patients with clinically important malnutrition may not have been recognized by the SGA. The SGA may fail to recognize some cases of malnutrition, in particular early and acute malnutrition. In addition, in acutely ill patients, it is difficult to make a clear determination of a patient’s nutritional status based on serum albumin alone. The NRI uses serum albumin level and the ratio of actual to usual weight.

There are arguments for not considering hypoalbuminemia as a marker of the degree of malnutrition. For instance, in cases of anorexia nervosa, normal albumin levels are relatively preserved until late in the course. In addition, nutritional support often fails to improve serum albumin levels. For these reasons, hypoalbuminemia has been reported to be a predictor of risk in a broad sense, rather than a parameter for identifying or quantifying malnutrition. [30] In this respect, the NRI may not be specific for the diagnosis of malnutrition in all hospitalized patients.

In conclusion, despite these limitations in markers of nutritional status, both tests correlated with each other and with age, body weight, percentage of weight loss, anthropometric data, lymphocyte count, albumin, total cholesterol level, and length of hospital stay in hospitalized patients. Therefore, these two techniques can be used for nutritional assessment in hospitalized patients.

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