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BRIEF ARTICLE

Comparison of two nutritional assessment methods in gastroenterology patients

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Abstract

AIM: To investigate and compare efficacy and differences in the nutritional status evaluation of gastroenterology patients by application of two methods: subjective global assessment (SGA) and nutritional risk index (NRI).

METHODS: The investigation was performed on 299 hospitalized patients, aged 18-84 years (average life span 55.57 ± 12.84), with different gastrointestinal pathology, admitted to the Department of Gastroenterohepatology, Clinical and Hospital Center "Bezanijska Kosa" during a period of 180 d. All the patients, after being informed in detail about the study and signing a written consent, underwent nutritional status analysis, which included two different nutritional indices: SGA and NRI, anthropometric parameters, bioelectrical impedance analysis, and biochemical markers, within 24 h of admission.

RESULTS: In our sample of 299 hospitalized patients, global malnutrition prevalence upon admission varied from 45.7% as assessed by the SGA to 63.9% by NRI. Two applied methods required different parameters for an adequate approach: glucose level (5.68 ± 1.06 mmol/L *vs* 4.83 ± 1.14 mmol/L, $F = 10.63$, $P = 0.001$); body mass index (26.03 ± 4.53 kg/m^2 *vs* 18.17 ± 1.52 kg/m^2, $F = 58.36$, $P < 0.001$); total body water (42.62 ± 7.98 kg *vs* 36.22 ± 9.32 kg, $F = 7.95$, $P = 0.005$); basal metabolic rate (1625.14 ± 304.91 kcal *vs* 1344.62 ± 219.08 kcal, $F = 9.06$, $P = 0.003$) were very important for SGA, and lymphocyte count was relevant for NRI: 25.56% ± 8.94% *vs* 21.77% ± 10.08%, $F = 11.55$, $P = 0.001$. The number of malnourished patients rose with the length of hospital stay according to both nutritional indices. The discriminative function analysis (DFA) delineated the following parameters as important for prediction of nutritional status according to SGA assessment: concentration of albumins, level of proteins, SGA score and body weight. The DFA extracted MAMC, glucose level and NRI scores were variables of importance for the prediction of whether admitted patients would be classified as well or malnourished.

CONCLUSION: SGA showed higher sensitivity to predictor factors. Assessment of nutritional status requires a multidimensional approach, which includes different clinical indices and various nutritional parameters.

Key words: Nutritional status; Subjective global assessment; Nutritional risk index; Comparison

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INTRODUCTION

Many methods of assessment of nutritional status have been developed to identify malnourished patients or the risk for malnutrition. Most of them, such as subjective global assessment (SGA), Malnutrition Universal Screening Tool, Mini Nutritional Assessment, Nutritional Risk screening-NRS 2002, dealt with multiple components: medical history, dietary intake, amount of weight loss, biochemical variables, and anthropometric measurements[1-3]. SGA is a clinical assessment index which appeared to be the most widely used and applied in a variety of patient populations, especially in surgical, oncology patients and subjects with chronic renal disease[1,4-6]. The nutritional risk index (NRI), developed by Veterans Affairs Total Potential Nutrition Cooperative Study Group, is an objective screening nutritional tool and has predictive potential to identify patients who become nutritionally depleted during hospitalization or are at increased risk for disease complications[7]. There is divided opinion about "gold standard" techniques for determining a patient's nutritional status: some authors are of the opinion that SGA is more sensitive to any biochemical markers or anthropometric measurements alone and is the best predictor for hospital-related outcome than other nutritional indices[8-11], while others considers that NRI must reflect real risk for malnutrition independent of severity of disease[12,13].

In the present study we attempted to investigate differences in baseline nutritional parameters in patients with different digestive diseases and disorders and intended to estimate degrees of concordance between two applied nutritional assessment methods, SGA and NRI. Also, we aimed to evaluate parameters which significantly influence the nutritional state.

MATERIALS AND METHODS

The investigation was performed on 299 hospitalized patients, aged 18-84 years (average life span 55.57 ± 12.84), with different gastrointestinal pathologies, admitted to the Department of Gastroenterohepatology, Clinical and Hospital Center "Bezanijska Kosa" during a period of 180 d. Patients with the following diagnosis: gastritis/oesophagitis, inflammatory bowel disease, peptic ulcer disease, functional bowel disorders, chronic pancreatitis, decompensate chronic liver disease, compensate chronic liver disease, autoimmune hepatitis, were classified as the benign group, while individuals with gastric, colorectal and pancreatic cancer were classified as the malignant group. The patients included in the study met the following criteria: subjects older than 18 years, metabolic and clinical stability, stable state of consciousness, absence of any kind of morphological or abnormalities of extremities. Exclusion criteria for all subjects were edema, major cardio-respiratory resuscitation, severe hyperhydration in patients with liver cirrhosis, estimated by clinical and ultrasound examination.

Nutritional measurements

All the patients, after being informed in detail about the study and signing a written consent, underwent nutritional status analysis upon admission, using 2 different nutritional indices: SGA and NRI, anthropometric parameters, bioelectrical impedance analysis (BIA), and biochemical markers. All measurements were performed within 24 h of admission. The SGA[14] is a clinical nutritional index, which involved a standardized questionnaire consisting of dietary intake change, recent body weight changes, gastrointestinal symptoms, functional capacity, and physical signs of malnutrition (loss of subcutaneous fat or muscle mass, oedema, ascites). The standardized questionnaire was performed by a previously trained investigator, gastroenterologist (Filipović BF). Patients were classified into to three different groups: well-nourished (SGA-A), moderately malnourished (SGA-B) and severely malnourished (SGA-C). The NRI[15] was computed by equation, which included concentration of albumin and the ratio of actual to usual weight: NRI = (1.519 × serum albumin (g/L) + 0.417 × (present weight/usual weight × 100). NRI score higher than 100 indicates that the patient is at no risk, a score of 97.5 to 100 indicates low risk, a score of 83.5 to 97.5 indicates medium risk, and a score lower than 83.5 indicates high risk. In order to perform appropriate statistical analysis we merged all malnourished individuals into one group. The usual weight was defined as a stable weight over the last six months before admission. The standard laboratory tests were analyzed: complete blood count, concentration of albumin, total protein, cholesterol, C-reactive protein (CRP) and glucose level. The lymphocyte count was calculated from the total blood cell count, and the differential white blood cell count was obtained by an automated analyzer. Anthropometric variables were determined: body weight and height, triceps skin fold thickness, mid-arm and waist circumferences. Body height was measured to the nearest 0.5 cm with a stadiometer and body weight was measured with mechanical scales. Triceps skin fold thickness was measured with a skin caliper on the posterior upper arm, midway between the acromion and olecranon process. A skin fold

Table 1 Distribution of nutritional status upon admittance according to the gastrointestinal diagnosis observed by SGA and NRI

Nourishment status/diagnosis	SGA assessment[1]		NRI assessment[2]	
	Well	Malnourished	Well	Malnourished
Benign	140	76	90	126
Malignant	23	60	18	65
Total	163	136	108	191

[1]χ^2 = 46.24, DF = 1, P < 0.001; [2]Cochrans κ index = 0.367; P < 0.001. SGA: Subjective global assessment; NRI: Nutritional risk index.

thickness of 5 to 8 mm was determined as borderline fat stores, and of 3 mm or less as severe depletion. Mid-arm circumference was measured with non-stretch measuring tape, midway between the acromion and olecranon of the non-dominant arm, and 15 cm or less was an indicator of severe depletion of muscle mass. Both parameters were used to compute mid-arm muscle circumference (cm) according to the formula, as reported by Frisancho[16]: mid-arm circumference (cm)-[triceps skin fold thickness (mm) × 0.3412], as an estimate of muscle mass or lean tissue stores. Bioelectrical impedance was performed using a single frequency (50 kHz) Bioelectrical Impedance Analyzer, standard platform-based electrode system, model TANITA BC-418MA (TANITA CORPORATION, Tokyo, Japan). This analyzer has a Goal Setter function which calculates the amount of fat mass to be lost in order to achieve a selected target. All measurements were performed in the morning within 24 h of admission. Patients had fasted overnight. Patients were told to stand barefoot on the platform-based electrode system with both feet and to grip two electrodes with both hands. The following parameters were by default revealed by the built-in software: body mass index (BMI), basal metabolic rate (BMR), body fat mass (FM), fat free mass (FFM), total muscle mass (MM), total body water (TBW), impedance of whole body (IWH). Resistance was directly measured in Ohms at 50 kHz, 550 mA using BIA. "Impedance/index", which is defined as body height squared divided by resistance, was determined. The length of hospital stay was actual number of hospitalization days and was recorded retrospectively from the Hospital Administration. The study was approved by the Ethical Committee, Clinical and Hospital Center Bezanijska Kosa.

Statistical analysis

Statistical analysis was performed with a commercially available statistical software program (SPSS 13.0, Inc, Chicago Il, US). As well as the usual methods of descriptive statistics (mean, standard deviation- SD), we tested and obtained differences by Student *t* test for independent samples. Entire testing was performed at a 95% probability level. Concordance between the two assessment methods was analyzed by Cochran's κ (k) index. The value of κ index varies from 0 to 1: a value < 0.00 indicates less than chance, 0.00-0.20 poor, 0.21-0.40 fair, 0.41-0.60 moderate, 0.61-0.80 substantial and 0.81-1.00 almost perfect concordance. The predictive potential of analyzed parameters was evaluated by the analysis of discriminant function.

Table 2 Differences in laboratory values of obtained parameters according to the applied nutritional scores (mean ± SD)

Parameters (serum)	Well	Malnourished	Significance *t* test
SGA assessment	n = 163	n = 136	
Glucose (mmol/L)	5.68 ± 1.06	4.83 ± 1.14	F = 10.63, P = 0.001
Cholesterol (mmol/L)	5.52 ± 0.96	3.54 ± 0.79	F = 10.61, P = 0.001
C reactive protein (mg/L)	12.42 ± 16.48	22.08 ± 18.46	F = 11.44, P = 0.001
NRI assessment	n = 108	n = 191	
Lymphocyte count (%)	25.56 ± 8.94	21.77 ± 10.08	F = 11.55, P = 0.001
Cholesterol (mmol/L)	5.25 ± 1.04	4.27 ± 1.35	F = 8.27, P < 0.05
C reactive protein (mg/L)	11.25 ± 8.86	19.97 ± 20.93	F = 6.48, P < 0.05

Degrees of freedom = 297; NS: Not significant.

RESULTS

Prevalence

In our sample of 299 hospitalized patients in the gastroenterohepatology department the frequency of any degree of malnutrition at admission varied from 45.7% as assessed by the SGA to 63.9% by NRI (Table 1). No significant differences were obtained in gender distribution of malnutrition (χ^2 for SGA = 1.05, DF = 1, P > 0.05; χ^2 for NRI = 2.63, DF = 1, P > 0.05). Age did not significantly differ between well-nourished and malnourished patients (F = 0.53, DF = 1, P > 0.05). A degree of corroboration between the two screening methods for assessment nutritive status, SGA and NRI, was revealed as fair concordance (Table 1).

Nutritional parameters

The mean values and SD of the laboratory, anthropometric characteristics and parameters of bioelectrical impedance analysis according to both applied nutritional methods were shown on Tables 2, 3 and 4. Moreover, the number or malnourished patients rose with the length of hospital stay according to both nutritional indices (Table 5). The discriminative function analysis (DFA) delineated the following parameters as important for prediction of nutritional status according to SGA assessment: concentration of albumins, level of proteins, SGA score and body weight. The DFA extracted MAMC, glucose level and NRI scores as the variables of importance for the prediction to whether admitted patients will be classified as well or malnourished (Table 6). The correctness of the equations was emphasized by the accuracy test computed from the examined group (93. 7% and 100%).

Table 3 Distribution of anthropometric measures and parameters of bioelectrical impedance analysis obtained by SGA (mean ± SD)

Parameters	SGA assessment		Significance *t* test
	Well *n* = 163	Malnourished *n* = 136	
MAC (cm)	28.28 ± 2.70	23.21 ± 2.06	$F = 10.20$, $P = 0.002$
MAMC (cm)	11.56 ± 12.62	8.23 ± 10.47	$F = 73.22$, $P < 0.001$
TSF (mm)	9.92 ± 2.47	5.25 ± 1.77	$F = 5.92$, $P = 0.02$
Waist circumferences (cm)	90.16 ± 10.92	70.03 ± 8.01	$F = 24.56$, $P < 0.001$
Body mass index (kg/m^2)	26.03 ± 4.53	18.17 ± 1.52	$F = 58.36$, $P < 0.001$
Total body water (kg)	42.62 ± 7.98	36.22 ± 9.32	$F = 7.95$, $P = 0.005$
Resistance of whole body (Ω)	545.86 ± 89.97	661.50 ± 98.89	$F = 4.77$, $P = 0.03$
Basal metabolic rate (kcal)	1625.14 ± 304.91	1344.62 ± 219.08	$F = 9.06$, $P = 0.003$
Impedance-index	55.3184 ± 13.00	46.4059 ± 9.33	$F = 6.73$, $P = 0.01$

Degrees of freedom = 297. MAC: Mid-arm circumferences; MAMC: Mid-arm muscle circumferences; TSF: Triceps skinfold thickness.

Table 4 Differences in anthropometric measures and parameters of bioelectrical impedance analysis obtained by NRI (mean ± SD)

Parameters	NRI assessment		Significance *t* test
	Well *n* = 108	Malnourished *n* = 191	
MAC (cm)	27.51 ± 2.73	25.11 ± 3.60	$F = 7.88$, $P = 0.005$
MAMC (cm)	10.63 ± 12.42	9.68 ± 11.41	$F = 11.55$, $P = 0.001$
TSF (mm)	9.09 ± 2.72	7.06 ± 3.20	$F = 11.55$, $P = 0.007$
Waist circumferences (cm)	88.51 ± 10.71	76.76 ± 13.81	$F = 7.14$, $P = 0.008$
Resistance of whole body (Ω)	554.40 ± 91.07	623.37 ± 112.57	$F = 5.98$, $P = 0.02$
Impedance-index	54.36 ± 12.20	45.51 ± 12.03	$F = 6.82$, $P = 0.01$

Table 5 SGA and NRI assessments of nourished and malnourished patients according to the length of hospitalization

Length of hospital stay	SGA assessment		NRI assessment	
	Well *n* = 163	Malnourished *n* = 136	Well *n* = 108	Malnourished *n* = 191
< 10 d	90	26	58	58
> 10 d	73	110[1]	50	133[2]
Total	163	136	108	191

[1]$\chi^2 = 40.69$, DF = 1, $P < 0.001$; [2]$\chi^2 = 15.82$, DF = 1, $P < 0.001$.

Table 6 Discriminant function analysis for particular groups of analyzed variables

Status	Centroids	Section points	Selecting equation	Percentage of accuracy
SGA				
Well	-2.466	0.420	-2.58 + 0.04 × [albumins] - 0.038 × [proteins] + 2.83 × SGA score - 0.03 × body weight	100%
Malnourished	2.884			
NRI				
Well	1.72	0.365	-11.75 + 0.17 × MAMC -0.20 × [glucose] + 1.04 × NRI score	93.7%
Malnourished	-0.99			

DISCUSSION

In this paper, the authors intended to estimate the adequacy of nutritional assessments comparing two of the most often used methods: SGA and NRI. The prevalence of malnutrition in hospitalized patients was reported to vary between 20% and 60%. Higher prevalence has been revealed in the elderly and in patients with malignant diseases[17-20]. In our investigation the overall prevalence of malnutrition was significantly higher by NRI assessment methods (63.9%) than SGA nutritional score (45.7%). Observed differences in prevalence of malnutrition between indices could be the result of different scoring systems. The problem appears with the classification of the mildly malnourished, who, according to SGA, are adequately classified, while NRI assigns them to the group of moderately malnourished[21]. Schneider and Hebuterne[22] claimed that nutritional clinical indices are more sensitive and more accurate compared with a single nutritive parameter. The nutritional parameters used to determine malnutrition varied in different studies. Most authors revealed that levels of serum albumin and cholesterol decreased in malnourished individuals and this result indicated that hypoalbuminemia and low levels of cholesterol could to be a predictor of risk for malnutrition, rather than a parameter for identifying and quantifying nutritional status[23-26]. However, some authors suggested that serum albumin and body mass index are overestimated factors in the malnutrition assessment[27]. Our results sustained this opinion, at least considering albumins. In our clinical study cholesterol in lower concentrations correlated with poor nutritional status, according to both applied nutritional indices. Scalfi *et al*[28] have claimed that impedance-index was decreased in malnourished patients and several studies have demonstrated that BIA is strictly associated with fat free mass and total body water in healthy subjects and

in patients. Nevertheless, it is still debated whether and for what purpose BIA can be used in the evaluation of body composition changes[29-33]. Furthermore, our investigation showed that the impedance-index is significantly lower in malnourished patients when compared with other examinees.

Apparently, two applied methods requiring different parameters are needed for an adequate approach: glucose level, body mass index, total body water, basal metabolic rate are very important for SGA, and lymphocyte count is relevant for NRI. Results of several studies have suggested moderate to perfect concordance between the SGA and the NRI or between SGA and the mini nutritional assessment[13,34]. Some authors reported poor overlapping levels between the same assessment methods[21]. SGA has some limitations in evaluating nutritional status. First, the SGA is a clinical index which consists of subjective parameters to determine malnutrition. Second, the SGA failed to recognize the group of patients with mild degrees of malnutrition and some cases of malnutrition, particularly early and acute malnutrition. In prospective studies, SGA was demonstrated to be a good predictor of complications related with poor nutritional state[22,35,36]. On the other hand, the combination of serum albumin and weight loss, as presented in the NRI, would reflect nutritional risk and indicate severity of illness and adverse outcome[2,12]. According to our results, malnourished patients had a longer hospital stay than well-nourished patients, applying results from both nutritive techniques. Discriminant function analysis has outlined some nutritive variables such as concentrations of serum albumins, level of total protein, SGA score and body weight according to the SGA nutritional assessment method, while different nutritional parameters (MAMC, glucose level and NRI score) by the NRI assessment method have been extracted as predictors of whether individuals will be classified as well or malnourished.

In conclusion, SGA showed higher sensitivity to predictor factors, although the sensitivity of NRI methods was also very high. Assessment of the nutritional status requires a multidimensional approach, which includes different clinical indices and various nutritional parameters.

COMMENTS

Background

Many methods of assessment of nutritional status have been developed to identify malnourished patients or risk for malnutrition. Most of them such as subjective global assessment (SGA), Malnutrition Universal Screening Tool, Mini Nutritional Assessment, Nutritional Risk screening-NRS 2002-dealt with multiple components: medical history, dietary intake, amount of weight loss, biochemical variables, and anthropometric measurements.

Research frontiers

In the authors' investigation overall prevalence of malnutrition was significantly higher by nutritional risk index (NRI) assessment methods (63.9%) than SGA nutritional score (45.7%). The corroboration between the two methods, was, according to Cochrans κ index = 0.367, which could be interpreted as fair concordance.

Innovations and breakthroughs

The discriminative function analysis extracted MAMC, glucose level and NRI scores as the variables of importance for the prediction to whether admitted patients will be classified as well or malnourished. The correctness of the equations was emphasized by the accuracy test computed from the examined group (93. 7% and 100%).

Applications

SGA showed higher sensitivity to predictor factors, although the sensitivity of NRI was also very high. Assessment of the nutritional status requires a multidimensional approach, which includes different clinical indices and various nutritional parameters.

Terminology

The SGA is a clinical nutritional index, which involved a standardized questionnaire consisting of dietary intake change, recent body weight changes, gastrointestinal symptoms, functional capacity, and physical signs of malnutrition (loss of subcutaneous fat or muscle mass, oedema, ascites). The NRI-was computed by equation, which included concentration of albumin and the ratio of actual to usual weight: NRI = [1.519 × serum albumin (g/L) + 0.417 × (present weight/usual weight × 100]. The bioelectrical impedance analysis is a software based electrode platform variant system for the evaluation of the parameters of nutritional status.

Peer review

The authors have compared the two nutritional indices currently in use-SGA and NRI- for their efficacies in delineating malnutritional cases. The study has been conducted with a large number of patients. The data generated for comparison seems appropriate and suggests the corroboration between two screening methods for assessment of nutritional status.

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