Subjective Global Assessment of Nutritional Status in Cardiac Patients

Aurea Kaoru Yamauti, Marcelo Eidi Ochiai, Paula Sofia Bifulco, Moab Alves de Araújo, Rosiris Roco Alonso, Regina Helena Cunha Ribeiro, Antonio Carlos Pereira-Barretto

Hospital Auxiliar de Cotoxó do Hospital das Clínicas da FMUSP - São Paulo, SP, Brazil

Objective: To analyze the performance of Subjective Global Assessment of Nutritional Status (SGA) in diagnosing malnutrition in patients with heart disease.

Methods: One hundred and six hospitalized patients (53 with heart failure) completed an SGA questionnaire on their nutritional history (changes in body weight, dietary intake, gastrointestinal symptoms, functional capacity, and diagnosis) and underwent physical examination. Then, anthropometric measurements were obtained (body weight, mid-arm circumference, triceps skinfold thickness, and arm muscle circumference). Serum albumin, total lymphocyte count and anthropometric measurements were determined for the objective assessment of patients with congestive heart failure. An ROC curve was used to analyze sensitivity, specificity and accuracy of SGA compared to the objective assessment.

Results: Patients' age was 57.7 ± 15.7, and the majority was male (67.9%). The ROC curve showed score 16 as SGA cut-off point with the highest sensitivity (62.2%) and specificity (55.7%). The area under the curve was 0.601 (95% CI: 0.487 – 0.715). Anthropometric assessment showed malnutrition prevalence at 51.9% by SGA and 42.5% by, with accuracy of 65.3% in men and 44.1% in women. In patients with congestive heart failure, SGA assessed malnutrition prevalence was 60.4%, while objective assessment was 32.1% with accuracy of 67.6% in men and 31.3% in women.

Conclusion: SGA detected a greater number of malnourished patients than the objective evaluation. Its performance in identifying malnutrition was better in men. It also detected cardiac patients at nutritional risk.

Key words: Nutritional assessment, malnutrition, heart diseases, congestive heart failure.

Poor nutritional status is common in hospitalized patients and may affect morbidity and mortality rates. According to Velloso[1], mortality risk is twice greater in cardiac patients with moderate or severe protein-energy malnutrition. Therefore, it is essential that patients who are malnourished or at risk of developing malnutrition be identified soon after admission so that nutritional support may be provided to correct nutritional changes and improve the patient's prognosis.

Factors that may generate nutritional depletion are multiple. Anorexia is found in patients with mild heart failure, while cachexia is more frequent in patients with more severe congestive heart failure (CHF). Despite high incidence of malnutrition and its consequences, there is no universally accepted definition for diagnosing deficiencies, and nutritional assessment still relies on analyses of several combinations of anthropometric, biochemical, immunological, functional and body compositional data, in addition to dietary intake and clinical status evaluation[2-3], which are considerably time-consuming and costly.

Ideally, nutritional assessment should be practical, easy to perform, non-invasive, requiring no use of devices or supplementary examinations, applicable at the bedside, show appropriate sensitivity and specificity, and yield immediate result[4].

To complement the usual methods of nutritional evaluation, several authors are using Subjective Global Assessment (SGA) of Nutritional Status as a screening tool to detect patients at risk of developing malnutrition[2].

SGA has been used to evaluate the nutritional status of surgical patients with digestive tract diseases, including neoplasias, candidates for liver transplantation, AIDS patients, dialysis patients and institutionalized elderly people. However, there are no studies regarding its use in patients with heart disease or CHF. Therefore, the following questions may be raised: Is there any difference between traditional methods used to evaluate nutritional status and SGA in cardiac patients? How successful is SGA in identifying patients diagnosed as malnourished by traditional methods of nutritional assessment?

The purpose of this study was threefold: to compare the SGA method with anthropometric assessment in cardiac patients, to compare subjective and objective nutritional assessments in patients with congestive heart failure, and to

Mailing Address: Aurea Kaoru Yamauti •
Rua do Orfanato, 882/62-B 03131-010 – São Paulo, SP, Brazil
E-mail: aureaky@hcnet.usp.br
Manuscript received June 22, 2005; revised manuscript received December 12, 2005; accepted February 24, 2006.

analyze the performance of subjective global assessment of nutritional status in patients with heart disease

Methods

Study design - This was a cross-sectional study of patients admitted to the Hospital in two different periods: from 21/Nov/2001 to 23/Dec/2001 (Group 1) and from 24/Nov/2002 to 26/March/2003 (Group 2).

Patients - The research project was evaluated by the hospital's Research Ethics Committee, and data were collected after obtaining informed consent from every patient or responsible relative.

Inclusion criteria - Group 1: adult patients with heart disease of several etiologies. Group 2: adult patients with decompensated congestive heart failure, functional class IV (New York Heart Association), and left ventricular ejection fraction (LVEF) ≤ 0.50.

Exclusion criteria: Patients who remained at home for less than 15 days after the last hospital admission. Patients transferred from other hospitals where they had been for more than 3 days. Patients whose medical condition prevented them from having their body weight and anthropometric measurements taken. Patients unable to complete the questionnaire or with no caregiver.

Echocardiogram: Left ventricular ejection fraction was determined by echocardiography during admission or up to one year before admission, using the Teichholz or Simpson's method[5].

Criteria for defining ventricular dysfunction etiology - Ischemic: myocardial infarction on electrocardiogram, history of myocardial revascularization or coronary obstruction documented by coronary angiography.

Hypertensive: history or record in the patient's medical chart of high blood pressure and ventricular hypertrophy on echocardiogram.

Chagasic: positive serology by ELISA or indirect immunofluorescence method.

Iidiopathic: absence of the above criteria.

Others: alcoholic, due to heavy alcohol consumption prior to the onset of heart failure condition; valvar, because of valvular dysfunction prior to the ventricular dysfunction and peripartum.

Nutritional assessment - All patients underwent subjective assessment using the SGA questionnaire and objective assessment through anthropometric measurements of upper extremities.

Objective assessment of Group 2 consisted of anthropometric measurements, serum albumin levels, and total lymphocyte count.

Data were collected by trained nutritionists, and those items of the SGA questionnaire relative to the degree of metabolic stress and edema were evaluated by the same cardiologist.

Nutritional subjective global assessment (SGA) - The subjective global assessment was performed during the first three days after hospital admission. The questionnaire used for applying SGA was that systematized by Detsky et al[6] and adapted according to the Waitzberg and Ferrini's description[7] (appendix 1).

This questionnaire covered the patient's history and physical examination. History taking included data concerning body weight, dietary intake, gastrointestinal symptoms, functional capacity, and degree of stress imposed by the disease.

With regard to dietary intake, patients were asked about changes in eating patterns, and each altered pattern was assigned a certain number of points, with partial total ranging from 0 to 11 points.

Gastrointestinal symptoms persisting frequently for two weeks or more were considered significant. Scoring for this item ranged from 0 to 6 points.

Functional capacity was worth 0 to 2 points. Functional capacity less than normal included reduced levels of physical activity at home, especially normal daily activities, for more than two weeks due to the disease.

Current body weight was taken by the nutritionist using a Filizola™ digital scale with a maximum capacity of 150 kg and accurate to 0.1 kg. Patients and their caregivers were asked about changes in body weight over the last six months. Percentage of body weight loss (%BWL) was calculated according to the formula below:

$$\text{BWL (\%)} = \frac{\text{Usual body weight} - \text{Current body weight}}{\text{Usual body weight}} \times 100$$

The body weight was scored from 0 to 4, according to the answers.

Catabolism associated with the disease was analyzed through the degree of stress. Stress level was considered moderate in patients with decompensated heart failure and severe in patients with cardiogenic shock receiving intravenous positive inotropic agents. This item was scored from 0 to 3 points.

On physical examination, the presence of edema was evaluated, as well as subcutaneous fat loss and muscle wasting. A +1 or +2 value was assigned for each item present, according to the degree of involvement. The score ranged from 0 to 10 points.

According to the sum of points assigned to each item, patients were initially classified in: Well-nourished: < 17 points. Malnourished (moderate and severe): ≥ 17 points.

Based on the diagnosis of malnutrition by the objective method, the SGA score with greatest sensitivity and specificity was determined.

Anthropometric assessment - Soon after SGA, all patients were assessed for anthropometric parameters, including mid-arm circumference (MAC) and triceps skinfold thickness (TSF), measured at the midpoint between the olecranon and acromial processes on the non-dominant arm.

Mid-arm circumference was measured to the nearest 0.1

cm with a nonstretch fiberglass tape graduated from 0 to 150 cm. Triceps skinfold thickness was measured to the nearest 0.1 mm using a Baseline™ skinfold caliper graduated with a 60 mm scale. Anthropometric measurements were taken three times consecutively, and the mean value was used. Arm-muscle circumference (AMC) was calculated using the formula: AMC (cm) = MAC (cm) - [3.14 x TSF (cm)].

Patients were classified as malnourished when at least two anthropometric measures were below the 5th percentile of Frisancho's reference values[8,9].

Laboratory tests - In patients of Group 2, serum albumin and total lymphocyte count were determined. All assays were carried out at the clinical laboratory of the Heart Institute (InCor) of the University of São Paulo Madical School, using the following methods: Serum albumin: bromocresol green method; Total lymphocyte count: automated blood cell counter and/or morphological evaluation on stained blood smears; Patients with serum albumin levels < 3.5 g/dL and total lymphocyte count < 1.200 cells/mm^3 were classified as malnourished.

In order to classify the nutritional status of patients belonging to Group 2, according to anthropometric parameters and laboratory tests, a criterion was established by the combined analysis of nutritional classification obtained through anthropometric assessment, serum albumin, and total lymphocyte count. Patients were considered malnourished or well-nourished when at least two variables showed similar classification.

Statistical analysis - Continuous variables were expressed as mean and standard deviation, and categorical variables were expressed as absolute number and percentage (%). Patients were classified as well-nourished or malnourished by SGA and in normal or malnourished by anthropometric and laboratory parameters.

Classification according to the objective nutritional assessment was taken as reference for calculation of SGA sensitivity and specificity.

The proportion of malnourished patients in both assessments was compared using Fisher's exact test or chi-square test (χ^2). P value < 0.05 was considered statistically significant.

The receiver operating characteristic (ROC) curve was used to determine the cut-off point of greatest sensitivity and specificity in identifying malnourished cardiac patients. Every patient was classified as well-nourished or malnourished according to SGA at different cut-off points. SGA sensitivity and specificity were calculated for each cut-off point relative to the objective assessment, and the ROC curve was generated using the SPSS statistical software (Chicago, IL, EUA).

Results

One hundred and six patients (mean age 57,7 ± 15,7) were evaluated, 72 of whom (67.9%) were male. Baseline characteristics of patients in Group 1 are shown in Table 1. Left ventricular ejection fraction of patients in Group 2 was 0.27± 0.08. Ventricular dysfunction etiologies are shown in Table 2.

Diagnosis	No	%
Heart failure (ejection fraction: 0.34 ± 0.13)	28	52.8
Coronary failure	6	11.3
Pulmonary thromboembolism	4	7.5
Aortic stenosis	4	7.5
Mitral regurgitation	3	5.7
Chronic obstructive pulmonary disease	2	3.8
Pacemaker infection	1	1.9
Atrial septal defect	1	1.9
Aorta aneurysm	1	1.9
Syncope	1	1.9
Bronchopneumonia	1	1.9
Not available	1	1.9
Total	**53**	**100.0**

Table 1 - Baseline characteristics of Group 1

Etiology	No	%
Hypertensive cardiomyopathy	15	28.3
Ischemic cardiomyopathy	14	26.4
Chagas cardiomyopathy	13	24.5
Idiopathic cardiomyopathy	8	15.1
Others	3	5.7
Total	**53**	**100.0**

Table 2 - Etiologies of ventricular dysfunction of patients in Group 2

Figure 1 illustrates the ROC curve showing score 16 as the SGA cut-off point with greatest sensitivity (62.2%) and specificity (55.7%) in identifying malnourished patients of both genders, all patients taken into account. The area under the curve was 0.601 (95% confidence interval: 0.487 – 0.715). At this SGA cut-off point, malnutrition prevalence was 51.9% (50% of the men and 55.9% of the women) and by anthropometric assessment, 42.5% (48.6% of the men and 29.4% of the women). Twenty-four men were classified as eutrophic and 23 as malnourished by either SGA or anthropometric assessment, with 65.3% accuracy (p = 0.009). In women, this concordance was observed in 10 and 5 patients, respectively, with 44.1% accuracy (p = 0.718).

Malnutrition was especially prevalent in Group 2 patients. The SGA malnutrition rate, based on a score of 16, was 60.4% (59.5% of the men and 62.5% of the women) and the anthropometric assessment, 50.9% (56.8% of the men and 37.5% of the women). Thirteen patients (10 men and 3 women) were diagnosed as eutrophic and 19 patients (16 men and 3 women) as malnourished by either SGA or anthropometric assessment. Accuracy among male patients was 70.3%, and among female, 37.5%. SGA sensitivity was

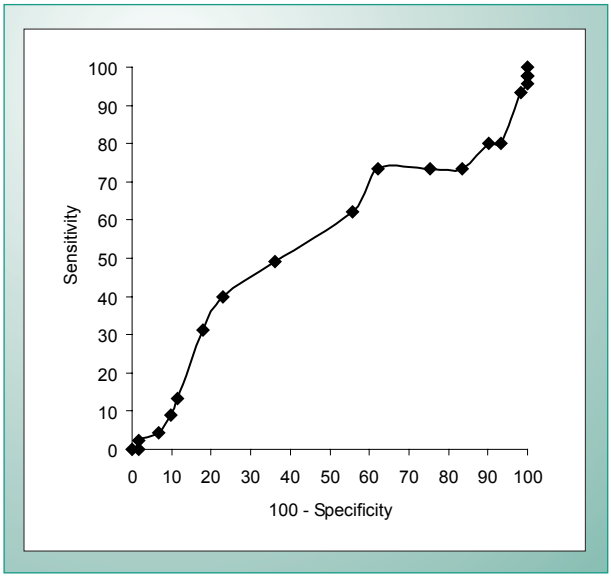

Fig. 1 - *ROC Curve (Receiver Operating Curve); n= 106; AUC = 0.601 (95% CI: 0.487 – 0.715).*

70.4% (76.2% in men and 50% in women).

Additionally, objective assessment (anthropometry and laboratory tests) found malnutrition prevalence in Group 2 patients of 32.1%, 37.8% among men and 18.8%, among women. A concordance was found between SGA and objective assessment (anthropometry and laboratory tests) in the diagnosis of eutrophia and malnutrition of 17 patients (13 men and 4 women) and 13 patients (12 men and 1 woman), respectively. Accuracy was 67.6% in men and 31.3% in women. SGA sensitivity was 76.5% (85.7% in men and 33.3% in women), based on anthropometry and laboratory tests.

Discussion

Study limitations - Subjective global assessment of nutritional status was originally developed and validated to identify nutritional risk in surgical patients. It is an essentially clinical method that has been adapted for use in several situations[10]. SGA depends on the interviewer's training and on the interpretation of the collected data, the subjectivity of which may be minimized by assigning points to questionnaire items.

The SGA malnutrition rate may have been underestimated, because the questionnaire applied did not discriminate weight gain due to sodium and water retention, common in patients with heart failure.

In this study, the anthropometric measurements of 18 patients (17%) older than 74 were compared with reference values of the 65-74 age group of the Frisancho table. Therefore, the lack of tables for the Brazilian population and also for people older than 74 may have influenced the anthropometric assessment.

There is no gold standard for the diagnosis of malnutrition based on objective assessment; this thus limits comparative studies.

Malnutrition prevalence - In this study, malnutrition prevalence by SGA was 9.4% higher than that by anthropometric assessment. It is supposed that SGA makes it possible to identify patients at risk of developing malnutrition before changes in anthropometric measurements occur.

Malnutrition rates by SGA and anthropometric assessment were similar in men. In women, the SGA malnutrition rate was higher. This finding may be explained by differences in skinfold measurement of both genders. According to the 50th percentile of Frisancho's table[8,9], the TSF of eutrophic women is 2.2-fold higher than that of men, meaning that basic measurements are greater in women. For the diagnosis of malnutrition, according to 5th percentile values, women would have to reduce 14 mm of the TSF measurement, while men would have to reduce 6.5 mm. As for MAC, women would have to reduce 6.1 cm and men, 5.5 cm. Accordingly, for the same degree of nutritional depletion, men would be diagnosed as malnourished by the anthropometric assessment before the women were assessed.

Our findings (SGA prevalence of 51.9%) are comparable to the 50.2% malnutrition rate found in the 9348 patients who participated in the multicenter ELAN study (Latin American Nutrition Study)[10]; 54% of the 175 patients with digestive tract disease [11] and 54% of the 59 hemodialysis patients[12].

In hospitalized patients, other authors have reported different malnutrition rates than those found in this study: 85% in candidates for liver transplantation[13] (n=20); 70% in elderly women[14] (n=23); 69.5% in patients with digestive tract neoplasia [15] (n=23); 48.1% in the Inquérito Brasileiro de Avaliação Nutricional Hospitalar (Hospital malnutrition: the Brazilian national survey)[16] (n=4000); 47.8% (n=90) and 40.9% (n=369) in elderly patients[17,18], and 17% in most AIDS patients[19] (n=100).

In Group 2, the number of malnourished patients was higher by SGA than by the objective assessment (60.4% *vs.* 32.1%, respectively). This difference was greater than that reported by Ek et al[17], who identified an approximately 20% higher SAG rate of malnutrition among hospitalized elderly as compared to the objective assessment.

SGA accuracy and sensitivity - In patients of Group 2, concordance in diagnosis of eutrophia and malnutrition between the methods was moderate. SGA accuracy and sensitivity was greater among men than among women.

SGA showed good sensitivity in identifying patients diagnosed as malnourished by objective assessment (anthropometry and laboratory tests). The value found (76.5%) was lower than the 82% sensitivity reported by Detsky et al[20] in the study of 59 surgical patients and 85.2% reported by Ek et al[17].

Conclusion

SGA identified a greater number of malnourished patients than traditional methods of nutritional assessment. Score 16 was the most accurate for diagnosing malnutrition. In patients with congestive heart failure, SGA showed a higher rate of malnutrition in men than in women.

Appendix 1 - Questionnaire of Subjective Global Assessment of Nutritional Status

A. Patient history

1. Body weight

(1) Changed over the last 6 months ( ) yes ( ) no

(1) Is still losing weight ( ) yes ( ) no

Current body weight _____ kg Usual body weight _____ kg

Body weight loss (BWL) ____ % If > 10% (2) ( )

If < 10% (1) ( )

Partial total of points _____

2. Dietary intake

(1) Change in diet ( ) yes ( ) no

The change was to:

(1) low-calorie diet

(2) non-solid low-calorie diet

(2) liquid diet >15 days or intravenous solution > 5 days

(3) fasting > 5 days

(2) persistent change > 30 days

Partial total of points _____

3. Gastrointestinal symptoms

(1) ( ) dysphagia and/or odynophagia

(1) ( ) nausea

(1) ( ) vomiting

(1) ( ) diarrhea

(2) ( ) anorexia, bloating, abdominal pain

Partial total of points _____

4. Functional capacity (more than 2 weeks)

(1) ( ) less than normal

(2) ( ) bedridden

Partial total of points _____

5. Diagnosis

(1) ( ) low stress

(2) ( ) moderate stress

(3) ( ) high stress

Partial total of points _____

B. Physical examination

(0) normal

(+ 1) slight or moderately depleted

(+ 2) severely depleted

( ) loss of subcutaneous fat (triceps, chest)

( ) striated muscle

( ) sacral edema

( ) ascites

( ) ankle edema

Partial total of points _____

C. SGA category

( ) well-nourished < 17 points

( ) moderately malnourished 17 ≤ 22 points

( ) severely malnourished > 22 points

Sum of the total number of points _____

References

1. Velloso LGC. Repercussão nutricional na miocardiopatia dilatada: estudo de indicadores do estado nutricional na insuficiência cardíaca em fase avançada. [tese de doutorado]. São Paulo: Faculdade de Medicina da Universidade de São Paulo; 1996.
2. Silva MCGB. Avaliação subjetiva global. In: Waitzberg DL. Nutrição oral, enteral e parenteral na prática clínica. 3ª ed. São Paulo: Atheneu; 2000. p. 241-53.
3. Waitzberg DL, Ferrini MT. Exame físico e antropometria. In: Waitzberg DL. Nutrição oral, enteral e parenteral na prática clínica. 3ª ed. São Paulo: Atheneu; 2000. p. 255-78.
4. Correia MITD. Avaliação nutricional subjetiva. Rev Bras Nutr Clin. 1998; 13: 68-73.
5. Borow K. An integrated approach to the noninvasive assessment of left ventricular systolic and diastolic performance. In: Sutton MSJ, Shaw PO. Textbook of adult and pediatric echocardiography and doppler. Cambrige: Blackwell Scientific Publications; 1989. p. 97-155.
6. Detsky AS, McLaughlin JR, Baker JP, Johnston N, Whittaker S, Mendelson RA, et al. What is subjective global assessment of nutritional status? JPEN J. Parenter. Enteral Nutr. 1987; 11: 8-13.
7. Waitzberg DL, Ferrini MT. Avaliação nutricional. In: Waitzberg DL. Nutrição enteral e parenteral na prática clínica. 2ª ed. São Paulo: Atheneu; 1995. p. 127-52.
8. Frisancho AR. Anthropometric standards for the assessment of growth and nutritional status. Michigan: The University of Michigan Press; 1990.
9. Frisancho AR. New norms of upper limb fat and muscle areas for assessment of nutritional status. Am J Clin Nutr. 1981; 34: 2540-5.
10. Correia MIT, Campos ACL. ELAN Cooperative Study. Prevalence of hospital malnutrition in Latin America: the multicenter ELAN study. Nutrition. 2003; 19: 823-5.
11. Hirsch S, de Obaldia N, Petermann M, Rojo P, Barrientos C, Iturriaga H, et al. Subjective global assessment of nutritional status: further validation. Nutrition. 1991; 7: 35-7.
12. Kalantar-Zadeh K, Kleiner M, Dunne E, Ahern K, Nelson M, Koslowe R, et al. Total iron-binding capacity-estimated transferrin correlates with the nutritional subjective global assessment hemodialysis patients. Am J Kidney Dis. 1998; 31: 263-72.
13. Hasse J, Strong S, Gorman MA, Liepa G. Subjective global assessment:

alternative nutrition assessment technique for liver transplant candidates. Nutrition. 1993; 9: 339-43.

14. Cordeiro RG, Moreira EAM. Avaliação nutricional subjetiva global do idoso hospitalizado. Rev Bras Nutr Clin. 2003; 18: 106-12.

15. Faintuch J, Cohen RV, Machado MCC, Pinotti, WH. Avaliação nutricional subjetiva de pacientes cirúrgicos com câncer: resultados preliminares. Rev Paul Med. 1988; 106: 155-60.

16. Waitzberg DL, Caiaffa WT, Correia MITD. Inquérito brasileiro de avaliação nutricional hospitalar (Ibranutri). Rev Bras Nutr Clin. 1999; 14: 124-33.

17. Ek AC, Unosson M, Larsson J, Ganowiak W, Bjurulf P. Interrater variability and validity in subjective nutritional assessment of elderly patients. Scand J Caring Sci. 1996; 10: 163-8.

18. Covinsky KE, Martin GE, Beyth RJ, Justice AC, Sehgal AR, Landefeld CS. The relationship between clinical assessments of nutritional status and adverse outcomes in older hospitalized medical patients. J Am Geriatr Soc. 1999; 47: 532-8.

19. Coppini LZ, Waitzberg DL, Ferrini MT, Silva MLT, Gama-Rodrigues J, Ciosak SL. Comparação da avaliação nutricional subjetiva global vs. avaliação global objetiva. Rev Assoc Med Bras. 1995; 41: 6-10.

20. Detsky AS, Baker JP, Mendelson RA, Wolman SL, Wesson DE, Jeejeebhoy KN. Evaluating the accuracy of nutritional assessment techniques applied to hospitalized patients: methodology and comparisons. JPEN J Parenter Enteral Nutr. 1984; 8: 153-9.