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Original article

Are malnourished patients complex patients? Health status and care complexity of malnourished patients detected by the Short Nutritional Assessment Questionnaire (SNAQ)

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Abstract

Background: This article describes the characteristics of patients identified as malnourished using the Short Nutritional Assessment Questionnaire (SNAQ) in terms of health status (quality of life, functional capacity, and body composition) and care complexity. We expected that by using the quick and easy SNAQ method of screening on malnutrition, inferences could be made about general health status and care complexity. This information can be used for optimal multi-disciplinary treatment of the malnourished patient.
Methods: The research population consisted of a group of 588 patients admitted to internal medicine and surgery wards of the VU university medical center. Patients with a SNAQ score of at least 3 points were considered malnourished. The SNAQ score was compared to the health status, which was determined by serum albumin, hand grip strength, quality of life, body composition, and estimated care complexity.
Results: At admission, 172 patients (29%) had a SNAQ score of at least 3 points. These patients had a significantly poorer quality of life, poorer physical functioning, a lower fat free mass index, and higher care complexity.
Conclusion: These findings confirm our assumption that a considerable proportion of malnourished patients should be considered as complex patients and that malnutrition is an important aspect and indicator of overall health status of the patients. The SNAQ is a simple malnutrition screening tool, applicable in the current complex hospital situation, to identify these complex, malnourished patients.

Keywords: Malnutrition; Care complexity; Hospital; SNAQ; Screening

1. Introduction

Disease-related malnutrition exists in a high proportion of hospitalized patients and is caused by reduced food intake, malabsorption and/or catabolism [1]. Severe malnutrition is easily recognized, but in highly complex patients in whom malnutrition may be less severe and is part of an impaired health status, malnutrition tends to be recognized only in a late stage of the treatment [2].

Early recognition and treatment of malnutrition is of great importance because of the adverse consequences of malnutrition, such as impaired immune function [3,4], reduced respiratory functioning [5], reduced overall muscle strength and increased fatigue [6], impaired thermoregulation [7], impaired wound healing [8], increased apathy and depression, impaired social interactions, and increased self neglect [9].

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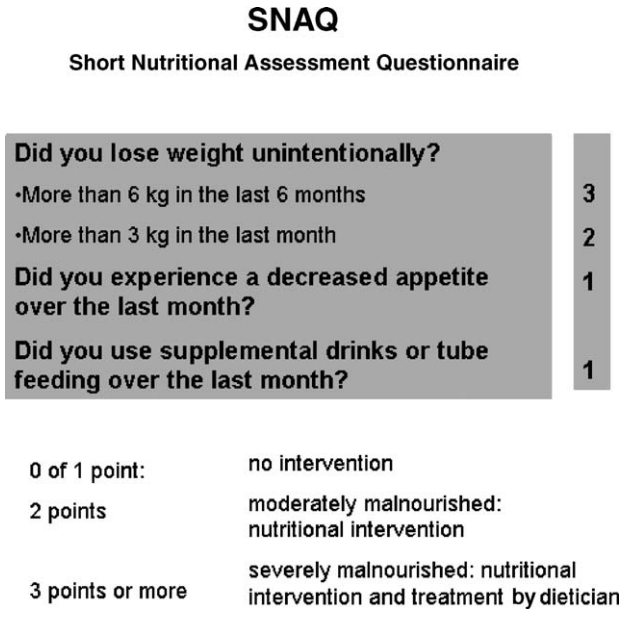

Fig. 1. The Short Nutritional Assessment Questionnaire (SNAQ).

Both malnutrition and disease severity can have independent negative effects on the prognosis of patients. In combination, these factors may create a vicious circle that can only be broken by combined treatment for the underlying disease and nutritional support. All malnourished patients, but specifically those who are medically complex patients, need to be recognized and treated in an early stage of the medical treatment.

An undisputed definition of disease-related malnutrition is lacking. BMI (kg/m^2) and unintentional weight loss are part of most definitions of malnutrition. The BMI–mortality curves suggest that, in the general adult population, a BMI of 18.5–25 kg/m^2 is preferable, since it is associated with the lowest mortality. Mortality is increased when the BMI is lower than 18.5 kg/m (underweight) and when the BMI is higher than 25 kg/m (overweight) [10]. Whereas a low BMI may indicate chronic malnutrition, recent unintentional weight loss indicates a more acute deterioration of the nutritional status. Nutritional variables combined with biochemical parameters are associated with severity of illness (such as low serum albumin) in so-called nutritional indices. These indices predict surgical risk and should, therefore, be termed health risk indices rather than nutritional indices. Serum albumin is an independent predictor of mortality in a wide range of clinical conditions, although deaths due to starvation may occur with a normal serum albumin concentration [10].

It has been recommended that all hospitals have protocols for nutritional screening, assessment, and referral [11]. Screening, as opposed to the more time-consuming and detailed process of nutritional assessment, should ideally be a quick and simple process that can be carried out by nurses at admission. In 2003, we developed a screening instrument, the Short Nutritional Assessment Questionnaire (SNAQ), containing three nutrition-related questions for which no calculation is needed. The SNAQ has proven to be valid and reproducible [12]. The early recognition and treatment of malnourished patients, using the SNAQ, has proven to be both effective and cost-effective [13]. In previous articles, we reported that patients with a SNAQ score of at least 3 points had a lower BMI, more involuntary weight loss, and higher hospital costs [12,13]. These patients were referred to a dietician and listed as malnourished in the medical charts. If we assume that malnutrition is part of a complex health problem, we might expect a high score on the SNAQ to be associated with impaired health status and increased care complexity. This information may optimize multi-disciplinary treatment of malnourished patients.

This article describes the characteristics of patients with a SNAQ score of at least 3 points in terms of health status (quality of life, functional capacity, and body composition) and care complexity (INTERMED-score).

2. Patients and methods

2.1. Patients

The research population consisted of a group of 588 patients admitted to a general internal ward (general internal medicine, gastroenterology, dermatology, rheumatology, nephrology) and a general surgical ward (general surgery and surgical oncology) of the VU university medical center in the periods April 2002 until October 2002 and February 2003 until June 2003. Patients who were not able to give informed consent, could not be weighed, had an expected length of hospital stay of less than 3 days, or who were younger than 18 years of age were excluded from the study. The study design was in accordance with the Declaration of Helsinki and was approved by the institutional review board of the VU university medical center.

2.2. Nutritional status according to the Short Nutritional Assessment Questionnaire (SNAQ)

The three questions on the SNAQ (Fig. 1) were posed at admission to the hospital by nurses from the wards. Patients with a SNAQ score of at least 3 points were considered to be severely malnourished.

2.3. Health status

2.3.1. Body weight, BMI, serum albumin, and hand grip strength

On the day of admission to the hospital, all patients were weighed on the same calibrated scale (SECA 880) and were asked their height. When patients did not know their height, it was measured (SECA 220). Patients were asked whether

Table 1
Differences in nutritional parameters, quality of life, and care complexity for the group of patients with a SNAQ score of three points or more in comparison with the other patients in the total group

	SNAQ ≥3 points	SNAQ score 0, 1, or 2 points	Difference between groups: *p*-value[a]
N	172	416	
Sex (male/female)	38%/62%	41%/59%	0.6 (c)
Age (years)	62.7±18.1	58.2±17.5	0.007 (t)
Older than 70 years (%)	44%	28%	<0.001 (c)
Nutritional and health status			
BMI (kg/m^2)	22.9±5.0	25.6±4.8	<0.0001 (t)
BMI<18.5 (%)	19%	2%	<0.0001 (c)
% Weight change in the past 6 months	−10.6±8,6	1.4±6.3	<0.0001 (m)
>10% involuntary weight loss (%)	48%	1%	<0.0001 (c)
Serum albumin (g/l)	32.6±6.7	35.3±6.6	<0.0001 (t)
Albumin<34 g/l (%)	53%	36%	<0.0001 (c)
Quality of life			
Mental combined score quality of life	41.3±10.5	46.0±11.0	<0.0001 (t)
Below the norm (50) (%)	77%	42%	0.01 (c)
Physical combined score	32.5±10.6	39.4±10.8	<0.0001 (t)
Below norm (50) (%)	95%	53%	<0.0001 (c)
Physical functioning	39.9±31.6	57.5±32.3	<0.0001 (m)
Role physical	17.2±32.2	45.4±44.6	<0.0001 (m)
Physical pain	50.6±22.5	59.2±24.7	0.005 (m)
General health	44.1±18.5	54.0±17,7	<0.0001 (m)
Vitality	42.0±20.9	53.6±21.0	<0.0001 (m)
Social functioning	44.9±24.5	57,6±26.5	<0.0001 (m)
Role emotional	45.2±47.4	65.1±45.2	<0.0001 (m)
Mental health	57.4±16.8	63.9±18.6	<0.0001 (m)
Care complexity			
INTERMED total score	16.4±8.4	12.5±6.9	<0.0001 (t)
>20 points (%)	27%	12%	<0.0001 (c)
Prognosis somatic care needs (% >1)	63%	56%	0.1 (c)
Prognosis psychological care needs (% >1)	12%	6%	0.04 (c)
Prognosis social care needs (% >1)	13%	4%	0.001 (c)
Prognosis health care needs (% >1)	38%	22%	0.3 (c)

[a] ((*t*-test (t), Mann–Whitney test (m), chi-square test (c)).

they had lost weight unintentionally over the last month and the last 6 months. The BMI was calculated as weight (kg)/height (m)^2. Serum albumin was also measured. Hand grip strength was measured in the non-dominant hand as the better of two readings on a mechanical dynamometer (Baseline, Smith and Nephew, USA). The measurement was performed as recommended by the American Society of Hand Therapists [14] and the standards of Mathiowtz et al. were used [15]. A trained researcher performed the measurements.

2.4. Quality of life

The validated Dutch version of SF-36 was used to assess quality of life [16]. This questionnaire is focused on physical, social and mental aspects of functioning and health. The SF-36 consists of 36 items organized into eight scales (physical functioning, social functioning, role limitations caused by physical problems, physical pain, mental health, role limitations caused by emotional problems, vitality and general health) [17]. Each of the scales was recoded into standardized scores with a scoring range between 0 and 100 (100=optimal functioning). The eight scales form two higher ordered clusters of the physical and mental composite scores. The norm is a score of 50 points [17].

2.5. Bio-impedance analysis

Whole body resistance and reactance were measured with four surface electrodes placed on the non-dominant wrist and ankle, as described by Lukaski et al. [18]. An electrical current of 50 kHz and 0.8 mA was briefly generated (Xitron 4000B analyser, Xitron technologies, San Diego, CA, USA) and applied to the skin with adhesive electrodes (3M Red Dot T, 3M Health care, Borken, Germany) with the patient lying in a supine position. Fat free mass (FFM) was calculated using the Geneva formula, which has been validated in 343 healthy subjects between 18 and 94 years with a BMI between 17.0 and 33.8 kg/m^2 [19]. This equation was also validated in elderly subjects [20]. The fat free mass index (FFMI) was calculated as FFM (kg)/length^2(m). Reference values of Kyle et al. were applied (16.7–19.8 kg/m^2 for men and 14.6–16.8 kg/m^2 for women) [21].

2.6. Care complexity: INTERMED

INTERMED is an observer-rated instrument to assess care complexity. It has been validated in several medical inpatient populations [22,23]. Information from four domains (biological, psychological, social, and health care) is integrated and assessed in the context of time (history, current state, and prognosis). In each of the four domains, five variables are rated from 0 to 3 according to a manual with clinical anchor points, resulting in a potential range of 0 to 60. Scoring is based on a patient interview and a review of the medical chart. The following variables were scored: (1) chronicity; (2) diagnostic dilemma; (3) severity of symptoms; (4) diagnostic challenge; (5) complications and life threat; (6) restrictions in coping; (7) prior psychiatric dysfunctioning; (8) resistance to treatment; (9) current psychiatric symptoms; (10) current mental health threat; (11) restrictions in integration; (12) social dysfunctioning; (13) residential instability; (14) restrictions in social network; (15) social vulnerability; (16) intensity of previous treatment; (17) prior treatment experience; (18) organization

Table 2
Odds ratios for a SNAQ score of three points or more and a score below the norm on the different domains of the quality of life (SF-36)

	Odds ratio	95% confidence interval
Physical functioning	2.4	1.6–3.8
Role physical	4.4	2.4–7.9
Physical pain	1.4	0.9–2.1
General health	2.4	1.5–3.9
Vitality	1.7	1.1–2.8
Social functioning	2.1	1.3–3.5
Role emotional	2.3	1.5–3.5
Mental health	1.7	1.0–2.8

of care; (19) appropriateness of referral; and (20) need for coordination of care.

A cut-off score of more than 20 points was found to be optimal in detecting patients at risk of longer length of hospital stay and poor quality of life at discharge. For this cut-off score, good inter-rater reliability was found, as indicated by a Kappa of 0.85 [24].

2.7. Statistics

Differences between groups were tested with an independent *t*-test, non-parametric Mann–Whitney test, or chi-square test where appropriate. Odds ratios (OR) with 95% confidence intervals (95% CI) were used to compare the prevalence numbers in the group of patients with a SNAQ score of at least 3 points with the patients with a SNAQ score of 0, 1, or 2 points. Statistical analysis was performed using SPSS 12.0 (SPSS Inc. Chicago).

3. Results

588 patients were included in the study. At admission, 172 patients (29%) had a SNAQ score of 3 points or more and were characterized as malnourished.

Table 1 shows the differences in nutritional parameters, quality of life, and care complexity of the group with a SNAQ score of at least 3 points compared with the patients with a low SNAQ score.

The patients with a SNAQ score of at least 3 points had a significantly higher age, a lower BMI, more unintentional weight loss, lower serum albumin, lower hand grip strength, and lower scores on all domains of quality of life and on all domains of care complexity.

3.1. Health status

3.1.1. Quality of life

The patients with a SNAQ score of at least 3 points had a significantly lower score than the other patients in all domains of quality of life. The OR for a SNAQ score of at least 3 points and a score on the quality of life below the norm for the different domains are shown in Table 2. The OR for the physical combined score was 5.3 (95% CI: 1.9–15.2) and the OR for the mental combined score was 2.0 (95% CI: 1.1–3.5). In the patients with a SNAQ score of at least 3 points, 95% had a physical combined score below the norm and 77% had a mental combined score below the norm.

3.1.2. Functional capacity

Hand grip strength was determined in 465 patients (79%); 123 measurements were missing, primarily because of logistic reasons (hand grip dynamometer not available or surgical procedure before the measurements could take place). A small number of patients were considered too ill to perform the tests. The patients with missing values had higher INTERMED scores.

Twenty-eight percent of the 465 patients had a SNAQ-score of at least 3 points. Sixty-seven percent of these patients with a high SNAQ score had a hand grip strength below the norm. In the patients with a low SNAQ score, this percentage was 51%. The mean percentage of the norm in the group with a low SNAQ score was higher than in the group with a SNAQ score of at least 3 points (Table 1).

3.1.3. Body composition

Impedance analyses was performed in a subgroup of 349 patients (60%; male/female=2:3) and the fat free mass (FFM) and fat free mass index (FFMI) were calculated. Thirty percent ($n=105$) of these patients had a SNAQ score of at least 3 points. The missing patients had higher INTERMED scores and were older.

Table 3 shows the results of the impedance analyses. All results are reported separately for men and women because body composition is different in both sexes.

In patients with a SNAQ score of at least 3 points, 41% had a low FFMI, 41% had a normal FFMI, and 18% had a high FFMI. The OR for patients with a SNAQ score of at least 3 points for having a low FFMI was 2.8 (95% CI: 1.7–4.5). Comparing the patients with a SNAQ score of at least

Table 3
Body composition and SNAQ score

	Men			Women		
	≥3 points	Other patients	*p*-value (*t*-test (t), chi-square (c))	≥3 points	Other patients	*p*-value (*t*-test (t), chi-square (c))
N	39	102		66	142	
Fat free mass index	17.4±1.6	18.8±2.3	<0.0001 (t)	15.1±2.3	16.2±2.0	0.001 (t)
FFMI (low/normal/high)	33%/59%/8%	19%/49%/32%	0.01 (c)	46%/30%/24%	20%/45%/35%	0.001 (c)

3 points and a low FFMI with the patients with a SNAQ score of at least 3 points and a normal FFMI, only the BMI of the patients with a low FFMI was significantly lower ($p<0.0001$). There was no difference in age, INTERMED-score, involuntary weight loss, quality of life, or hand grip strength.

3.1.4. Care complexity

Ninety-six patients had an INTERMED score of 20 points or more, of whom 46 had a SNAQ score of at least 3 points (sensitivity 48%, positive predictive value 27%). Of the remaining 492 patients, 126 had a SNAQ score of at least 3 points (specificity 74%, negative predicted value 88%). The mean INTERMED score in the total group was 13.6±7.6. In the group of patients with a SNAQ score of 3 points or more, the INTERMED score was higher (16.4±8.4, $p<0.0001$). The OR of patients with a high SNAQ score (≥3) for a high INTERMED score (>20) was 2.5 (95% CI: 1.6–3.9). The percentage of patients with a score of more than 1 point on the items 'mental health threat' (prognosis psychological care needs) and 'social vulnerability' (prognosis social care needs) was higher in the group of patients with a SNAQ score of at least 3 points (Table 1). The percentages of patients with a score of more than 1 point (care needs or acute care needs) on the items 'complications and life threat' (prognosis somatic care needs) and 'need for coordination of care' (prognosis health care needs) were not significantly different.

4. Discussion

We found that poor nutritional status, assessed by a simple screening instrument (SNAQ), is not an isolated problem but is very often related to poor overall health status and increased psychosocial care complexity.

Patients with a SNAQ score of at least 3 points had more health care needs, a poorer quality of life, lower functional capacity, and a lower FFMI. In this group, 54% was above the age of 70 years, 19% had a BMI below 18.5, 53% had a serum albumin level below normal (indicating chronic disease), and 48% had more than 10% unintentional weight loss. As to health status, 95% had a quality of life physical composite score below normal, 77% had a mental combined score below normal, 67% had a low hand grip strength, and 41% a low FFMI. Finally, 27% had a high care complexity. These combined findings underline the assumption that a considerable proportion of malnourished patients should be considered as complex patients and that malnutrition is an important aspect and indicator of overall health status of patients.

In 79% of the patients, hand grip strength was measured and in 60% of the patients a bioelectrical impedance (BIA) measurement was performed. The higher INTERMED score, the higher age, and the equivalent SNAQ-score of the not completely evaluated patients imply that the data presented on body composition and functionality were measured in a healthier subgroup with an identical prevalence of malnutrition. Again, patients with a SNAQ score of at least 3 points had substantially lower hand grip strength and lower FFM. In the group of patients in whom all measurements were performed, the differences in scores on nutritional parameters, quality of life, and care complexity were comparable to the results in the total group.

The body composition of the patients with a high SNAQ score was different from the body composition of the patients with a low SNAQ score. Patients with a high SNAQ score had a lower FFMI and, in this group, twice as many patients had a FFMI value lower than the norm. However, not all patients with a low FFMI were considered malnourished by the SNAQ score. This indicates that a simple screening procedure at admission to the hospital cannot fully substitute for an extensive nutritional assessment but is, by nature, intended to identify most of the patients who are malnourished or at risk of malnutrition.

Screening for malnutrition in all patients using the SNAQ and subsequent nutritional intervention has been proven to shorten the length of hospital stay in a subgroup of frail, malnourished patients and to be cost-effective in all hospital patients [13]. The SNAQ is a simple screening instrument with a high predictive value for impaired health status and increased care complexity. This instrument is suitable for the current complex hospital situation. For optimal communication, the three questions on the SNAQ should be integrated in the electronic medical chart. Use of a computerized detection system is an optimal strategy in a busy hospital environment.

General hospitals are increasingly confronted with complex patients. The high costs of our health care system have resulted in only the most complex patients being admitted to the hospital, whereas their treatment is often under heavy time constraints. For a growing number of patients, integrated treatment is essential, involving early coordination of care, geriatric interventions, and referral to medical and paramedical consultation services. INTERMED detects complex patients with a lower quality of life and a longer hospital stay. Interventions based on the INTERMED score improve the care process. Since many patients with an INTERMED score above 20 were also malnourished, it is advisable to integrate the SNAQ and its treatment into the INTERMED protocol. Special attention should be given to the social and psychological health care needs of malnourished patients as well since they are more at risk for problems in these areas.

In sum, patients with a SNAQ-score of 3 points or more are at risk of higher care complexity, a poorer quality of life, impaired physical functioning, and a lower FFMI. The simplicity of the SNAQ malnutrition screening tool makes it easy to apply in the current complex hospital situation so that complex malnourished patients who are in need of nutritional treatment can be identified and their underlying disease treated. Since patients who are identified as being

malnourished by the SNAQ are likely to have a higher care complexity, it is advisable to screen malnourished patients on care complexity and vice versa.

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