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Nutritional Screening of Patients Undergoing Surgery or Oncological Treatment in Four Croatian Hospitals

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Aim. To identify malnourishment of surgical and oncologic patients or those at risk of becoming malnourished at four hospital centers in Croatia by use of nutritional screening questionnaire developed specifically for the purpose of this study.

Method. The study included 1,639 adult patients: 1,475 scheduled for various surgical treatments and 164 oncologic patients receiving primary or adjuvant radio- and/or chemotherapy. The nutritional screening questionnaire consisted of data on recently reduced food intake and weight loss, body mass index (BMI), estimated period of perioperative fasting or oncologic disease status, categorization of surgical procedure, and additional stress expected. Each component was rated on a 0-2 or 0-3 scale. A score of seven points was chosen as the borderline between patients at risk of malnutrition (score ≤7) and those at no such risk (score 8-11). The questionnaire also included data on blood albumin, blood urea, blood lymphocyte count, blood creatinine, and overall patient evaluation by the physician.

Results. Reduced food intake and weight loss were reported by 20% and 33% of the patients, respectively. Median BMI was 26 (range, 23.2-28.9) and underweight BMI values (<20) were found in 7% of the patients. Screening questionnaire score of ≤7, indicating the risk of malnutrition, was obtained in 23% of 1,639 patients. Decreased albumin and lymphocytes were found in 10% and 17% of the patients, respectively. Increased urea and creatinine were found in 13% and 7% of the patients, respectively. Of the 288 patients examined by the physician, 41% were assessed as at risk of malnutrition and 9% as malnourished.

Conclusion. Nutritional screening questionnaire could be used for the identification of patients being at risk of malnutrition. An adequate prospective study is required for its final validation.

Key words: *Croatia; deficiency diseases; nutritional status; patients; perioperative care; questionnaires*

Malnutrition, defined as a nutritional deficit, has been recognized in patients as an important feature of adverse outcomes, including increased morbidity and mortality and decreased quality of life (1,2). Malnutrition also increases the duration of hospitalization as well as hospital expenses (1-3). As effective assessment of individual nutritional status is vital to patients' overall clinical management, it is important to identify malnourished patients and those at nutritional risk to treat and prevent malnutrition (1-7).

An assessment of patient's nutritional status is usually based on the evaluation of laboratory test results, anthropometric measurements, clinical history, physical examination findings, and the patient's subjective remarks. Different nutrition screening tools that have been developed suffer from various disadvantages, from being too complicated, time consuming, or too specialized to be implemented by the nursing or administrative staff, to being not sensitive and specific enough (2-5,8-13). The aim of this study was to identify malnourished surgical and/or oncologic patients or those at the risk of becoming malnourished by use of a nutritional screening questionnaire developed specifically for the needs of this research.

Subjects and Methods

Patients

The study population consisted of 1,639 adult patients (828 men and 806 women) undergoing treatment at four Croatian hospitals: Sisters of Mercy University Hospital (Hospital 1), University Hospital for Tumors (Hospital 2), Zagreb University Hospital Center (Hospital 3), and Rijeka University Hospital Center (Hospital 4). The period of patient enrollment lasted three months. Pa-

tients scheduled for surgical interventions from Hospital 1 (n = 100), Hospital 3 (n = 100), and Hospital 4 (n = 1,275) were interviewed and evaluated by anesthesiologists. Patients from Hospital 2 (n = 164) had either already undergone surgery and were undergoing adjuvant chemotherapy and/or radiotherapy, or were just on primary chemotherapy and/or radiotherapy. These patients were interviewed and evaluated by their ward physicians. Since the aim of the study was to perform a cross-sectional analysis of the patients' nutritional status, no inclusion criteria were defined and the number of patients was not restricted. It happened that the number of patients from Hospital 4 greatly exceeded those at other three Hospitals. Therefore, all results were analyzed and described jointly as well as separately for each hospital.

Nutritional Screening Questionnaire

Anesthesiologists or ward physicians collected the data from patient medical records or through interviews and physical examination of patients and filled out the nutritional screening questionnaire. The questionnaire consisted of four main parts (Table 1).

The first part of the questionnaire collected data on the patient's age, sex, weight, and height. Some of these data had already been available from the patients' charts. The patients' weight and height were measured on admission to hospital by ward nurses, who also took their venous peripheral blood for routine laboratory tests.

The second part covered subjective and objective assessment of body weight loss, appetite loss, body mass index (BMI), estimated period of perioperative fasting (Hospitals 1, 3, and 4) or status of the underlying oncologic disease (Hospital 2), and categorization of surgical procedure (Hospitals 1, 3, and 4; based on the "Reimbursement catalogue of the Health Insurance Company of Public Employees in Austria" – internal publication) or additional stress anticipated (Hospital 2). Data on patient's recent weight loss and change in food intake were collected from the patients through an interview, whereas data on plans for the treatment and disease stage were obtained from patient medical records and/or charts. Categorization of surgical procedures was based on the complexity of surgical procedures and/or the "grade" of trauma or stress induced in patients by surgical operations. Technically relatively simple surgical procedures, such as excisions and incisions, resections and repositions of minor fractures (of fingers or toes), were considered as "minor" procedures. Surgical procedures causing moderate level of trauma or stress to the patient, such as repositions of bigger joints, open repositions of a major fracture, tracheostomy, nerve anastomosis, appendectomy, exploratory laparotomy, gastroenterostomy, entero-enteral anastomosis, major skin grafts, drainage of an intraabdominal or intrathoracic abscess, were considered "medium" surgical procedures. Finally, surgical procedures with more extensive and complex resections, such as exploratory thoracotomy, internal organ resections (e.g., gastric, colon, pancreas, liver, and lung resections), or osteosynthesis, were considered "major" surgical procedures. Findings were scored 0, 1 or 2 points; in the case of weight loss during the previous months with 0, 1, 2 or 3 points. The maximum score was 11. Score 7 was chosen as a cut-off point between patients at risk of malnutrition (score ≤7) and those at no such risk (score 8-11). We assessed that score 7 would best reflect any deviation from normal or optimal condition.

The third part of the questionnaire collected the data on the following laboratory parameters: blood albumin (g/L or %), blood urea (mmol/L), blood lymphocyte count (% of leukocytes), and blood creatinine (μmol/L). These laboratory parameters were routinely measured and available within a day or two after patient's admission to hospital.

The fourth part of the questionnaire was intended for physician's assessment of the overall nutritional status of the patient (well-nourished, at risk of malnutrition, or malnourished).

Statistical Analysis

The data on patients' age, sex, weight, height, BMI (weight in kg/height in m^2), screening score values, and laboratory data were presented as median with the 25^{th}-75^{th} percentile range. All data sets used for the analysis of the screening score were complete. For descriptive statistics, the level of statistical significance set at <0.05, without p-value adjustments. Non-parametric Kruskall-Wallis, Mann-Whitney U, chi-square test, and Fisher's exact test were used to compare the groups. Associations between variables were analyzed by Spearman's-rho (two-tailed). The complete statistical analysis was performed by using SPSS software package, Version 11.0 (SPSS Inc., Chicago, IL, USA).

Table 1. Nutritional screening questionnaire designed for this study as a means of early assessment of patient nutritional status

Nutritional Screening Questionnaire
Initials
Date of birth
Admission number
Weight (kg)
Height (m)
Sex (F/M)
Day
Month
Year
A. A decline in food intake on the basis of appetite loss, digestive problems, swallowing or chewing problems, or neuropsychological disturbances, during the last three months:
0 = considerable decline in food intake
1 = reduced food intake
2 = no decline in food intake
B. Weight loss during the previous months:
0 = 5 kg
1 = patient does not know
2 = 1-5 kg
3 = none
C. Body mass index (BMI):
0 = 18
1 = 18-20
2 = 20)
D1. (Hospitals 1, 3, and 4, for patients undergoing operations). Estimated period of perioperative fasting (pre- and postoperative fasting days). Fasting is defined as oral food intake of 500 kcal/day:
0 = 5 days
1 = 3-5 days
2 = 1-2 days
D2. (only for patients at the Hospital 2). Underlying disease:
0 = progressive disease
1 = stable with tumor
2 = without tumor
E1. (Hospitals 1, 3, and 4, for patients undergoing operations). Scoring of surgical intervention:
0 = major
1 = medium
2 = minor
E2. (for patients at the Hospital 2). Additional stress anticipated:
0 = sepsis
1 = chemo-/radiotherapy and infection
2 = no infection
Result (maximum 11 points):
8-11 = no risk
< 7 = risk of malnutrition
Laboratory parameters:
Albumin (g/L or %)
Urea (mmol/L)
Lymphocyte counts (% L)
Creatinine (mol/L)
Total evaluation by the physician:
Well nourished
Risk of malnutrition
Malnutrition
Signature:

Results

Patient Characteristics

Patients' median age was 56 years (range, 42-67 years), and median BMI was 26 (range, 23.2-28.9; Table 2). More than half were men. The median screening score was not below the cut-off point in any of the

Table 2. Patient's characteristics (number or median with 25th-75th percentile range in parenthesis). Laboratory values are also presented in parallel as the number and percentage of patients outside of normal range (NR)

Patients' characteristics	Median (25th-75th percentile)
Age (years):	
Hospital 1 (n = 100)*	60 (44-69)
Hospital 2 (n = 164)*	60 (50-67)
Hospital 3 (n = 98)*	62 (49-71)
Hospital 4 (n = 1,260)*	55 (41-67)
total (n = 1,622)	56 (42-67)
Sex (male/female):	
Hospital 1(n = 100)	48/52
Hospital 2 (n = 164)	62/102
Hospital 3 (n = 99)	52/47
Hospital 4 (n = 1,271)	666/605
total (n = 1,634)	828/806
Weight (kg):	
Hospital 1 (n = 100)	76.1 (66.9-84.9)
Hospital 2 (n = 164)	74 (65-83)
Hospital 3 (n = 100)	69.5 (58-83)
Hospital 4 (n = 1,275)	76 (67-85)
total (n = 1639)	75 (66-85)
Height (m):	
Hospital 1 (n = 100)	1.68 (1.63-1.76)
Hospital 2 (n = 164)	1.65 (1.60-1.72)
Hospital 3 (n = 100)	1.76 (1.66-1.84)
Hospital 4 (n = 1,275)	1.70 (1.64-1.77)
total (n = 1639)	1.70 (1.63-1.77)
BMI (weight in kg / high in m2)†:	
Hospital 1	27.1 (24.2-29.2)
Hospital 2	26.7 (23.2-30.5)
Hospital 3	21.8 (19.5-25.8)
Hospital 4	26.0 (23.5-28.7)
total (n = 1,639)	26.0 (23.2-28.9)
Screening score values:	
Hospital 1 (n = 100)	9 (8-10)
Hospital 2 (n = 164)	8 (6-10)
Hospital 3 (n = 100)	7 (4-9)
Hospital 4 (n = 1,275)	10 (8-11)
total (n = 1639)	9 (8-11)
Albumin:	
Hospital 1 (g/L)	43 (39-45);
(normal 34.2-51.7) (n = 94)	4% < NR < 0%
Hospital 2 (%)	56 (52-59);
(normal 50.0-67.0) (n = 163)	14% < NR < 0%
Hospital 3 (g/L)	36 (29-42);
(normal 34.2-51.7) (n = 99)	43% < NR < 17%
Hospital 4 (g/L)	46 (42-50);
(normal 35-50) (n = 1274)	8% < NR < 20%
Urea (mmol/L):	
Hospital 1 (normal 3.8-8.3) (n = 97)	5.4 (4.2-6.4); NR < 6%
Hospital 2 (normal 2.2-8.0) (n = 164)	5.8 (4.6-7.2); NR < 15%
Hospital 3 (normal 2.8-8.3) (n = 99)	6.2 (4.2-9.2); NR < 29%
Hospital 4 (upper normal value 7.5) (n = 1,274)	5.1 (4.1-6.3); NR < 12%
Lymphocyte counts (% of leukocytes):	
Hospital 1	31.5 (26.7-36.2);
(normal 20-46) (n = 99)	7% < NR < 3%
Hospital 2	25.1 (18.1-31.9);
(normal 10-50) (n = 164)	8% < NR < 1%
Hospital 3	22.0 (18.0-29.5);
(normal 20-46) (n = 100)	27% < NR < 1%
Hospital 4	27.0 (21.0-33.0);
(normal 19-48) (n = 1,274)	18% < NR < 1%
Creatinine (mol/L):	
Hospital 1 (normal 35-115) (n = 98)	85 (76-93); NR < 6%
Hospital 2 (normal 63-115) (n = 164)	98 (86-111); NR < 18%
Hospital 3 (normal 64-125) (n = 99)	98 (76-136) ; NR < 34%
Hospital 4 (maximum 120) (n = 1,274)	81 (73- 92) ; NR < 4%

*Hospital 1 – Sisters of Mercy University Hospital, Zagreb; Hospital 2 – University Hospital for Tumors, Zagreb; Hospital 3 – Zagreb University Hospital Center; Hospital 4 – Rijeka University Hospital Center.
†Body mass index: < 20 – underweight, 20.0-24.9 – normal, 25.0-29.9 – overweight, > 30 – obese.

four hospitals (Table 2). Blood values of albumin, urea, lymphocyte count, and creatinine could not be presented as common median values for all four hospitals, because they slightly differed in the range of normal values or the units employed (e.g., concentration values or percentages).

Nutritional Assessment Form

Out of a total of 1,683 patients, four-fifths did not report reduced food intake (Table 3). The proportion of patients reporting reduced food intake significantly differed among hospitals ($p<0.001$). The greatest proportion of patients reporting reduced food intake was found in Hospital 3 (70%) and then in Hospital 2 (35%). According to patients' reports, 67% had no weight loss but the percentage significantly varied among the hospitals ($p<0.001$; Table 3). Hospital 3 had the smallest number of patients reporting no weight loss (26%), Hospitals 1 and 2 had twice as many, whereas Hospital 4 had almost three-fourths of patients with stable weight (74%).

According to BMI, 7% of the patients were underweight (BMI<20). However, the mean BMI above 24.9 recorded in patients at Hospitals 1, 2, and 4 indicated overweight (Table 2). Also, there were significant differences in BMI values among patients in these four hospitals ($p<0.001$).

Hospitals 1, 3, and 4 significantly differed in the number of days of perioperative fasting ($p<0.001$). One to two days of perioperative fasting was reported by 82% of the patients in Hospital 1, 37% in Hospital 3, and 65% in Hospital 4. With respect to planned surgical interventions (major, medium, or minor), there were no significant differences among these four hospitals ($p = 0.068$).

The patients in Hospital 2 were not evaluated on the basis of perioperative fasting but on the basis of their underlying disease. Forty-one percent of the patients could be classified as having no tumor, ie, as undergoing adjuvant treatment. In terms of anticipated additional stress, 2 points were given to 9% of the patients at Hospital 2, ie, these patients were not considered to be under additional stress.

In total, 23% of the analyzed patients could be described as being at risk of malnutrition, ie, their score was ≤7 (Table 3). Hospital 3 had the highest proportion of such patients (64%), followed by Hospital 2 (42%), Hospital 4 (18%), and Hospital 1 (15%). There was a significant difference among these hospitals in percentage of patients at risk of malnutrition ($p<0.001$). When score 6 was taken as a cut-off point, the percentage of patients assessed as malnourished decreased ("specificity improvement"), as expected, whereas the percentage of those without assigned malnutrition increased ("sensitivity loss") (data not shown). However, no principal change in characteristics of the subgroups was found.

The patients in four hospitals differed significantly in blood values of albumin, urea, lymphocyte count, and creatinine ($p<0.001$ for all; Table 4). Albumin concentration was decreased in 10% of all patients; the greatest proportion of patients with decreased albumin was found in Hospital 3 (43%). Increased urea concentrations were present in 13% of all patients included in the study, with the highest proportion at Hospital 3 (30%). Decreased lympho-

cyte count and increased creatinine concentration was found in 17% and 7% of all patients, again with the highest proportion at Hospital 3 (27% and 34%, respectively).

The last part of the Nutritional Screening Report Form contained patient overall nutritional status evaluation, which was performed by anesthesiologists in Hospitals 1 and 3, and by ward physicians in Hospital 2. Out of 288 patients evaluated, 50% were assessed as well-nourished, 41% were at the risk of malnutrition, and 9% were malnourished. The proportion of well-nourished patients was 78% in Hospital 1, 49%

Table 3. Results from the screening part of the nutrition assessment report form

	Hospital* (No. of patients, %)					
Question (point) or parameter	1	2	3	4	total (%)	p
A (reduced food intake):						
considerable (0)	–	18	30	63	111 (7.0)	
inferior (1)	15	39	40	120	214 (13.0)	
no decline (2)	85	107	30	1091	1,313 (80.0)	
total	100	164	100	1,274	1,638 (100.0)	0.001†
B (weight loss):						
5 kg (0)	8	23	25	53	109 (7.0)	
not known (1)	1	25	24	154	204 (12.0)	
1-5 kg (2)	41	28	25	128	222 (14.0)	
none (3)	50	88	26	940	1,104 (67.0)	
total	100	164	100	1,275	1,639 (100.0)	0.001†
C (body mass index):						
18 (0)	–	3	9	12	24 (2.0)	
18-20 (1)	4	11	30	45	90 (5.0)	
20 (2)	96	150	61	1218	1,525 (93.0)	
total	100	164	100	1,275	1,639 (100.0)	0.001†
D1 (perioperative fasting):						
5 days (0)	3		19	110	132 (9.0)	
3-5 days (1)	15		43	330	388 (26.0)	
1-2 days (2)	82		37	835	954 (65.0)	
total	100		99	1,275	1,474 (100.0)	0.001†
D2 (underlying disease):						
progressive (0)		51			51 (31.0)	
stable (1)		46			46 (28.0)	
without tumor (2)		67			67 (41.0)	
total		164			164 (100.0)	
E1 (surgical intervention):						
major (0)	11		21	128	160 (11.0)	
medium (1)	57		39	611	707 (48.0)	
minor (2)	32		39	536	607 (41.0)	
total	100		99	1,275	1,474 (100.0)	0.068†
E2 (additional stress expected):						
sepsis (0)		3			3 (2.0)	
chemo/radiotherapy (1)		145			145 (89.0)	
no infection (2)		15			15 (9.0)	
total		164			164 (100.0)	
Screening score value:						
8-11 (no malnutrition risk)	85 (85.0)	95 (58.0)	36 (36.0)	1,050 (82.0)	1266 (77.0)	
7 (risk of malnutrition)	15 (15.0)	69 (42.0)	64 (64.0)	225 (18.0)	373 (23.0)	
total	100	164	100	1275	1,639 (100.0)	0.001‡
Laboratory parameters:						
Albumin:						
increased	–	–	17 (17.0)	260 (20.0)	277 (17.0)	
normal	90 (96.0)	141 (86.0)	39 (40.0)	916 (72.0)	1,186 (73.0)	
decreased	4 (4.0)	22 (14.0)	43 (43.0)	98 (8.0)	167 (10.0)	
total	94	163	99	1,274	1,630 (100.0)	0.001†
Urea:						
increased	6 (6.0)	24 (15.0)	29 (29.0)	153 (12.0)	212 (13.0)	
not increased	91 (94.0)	140 (85.0)	70 (71.0)	1,121 (88.0)	1,422 (87.0)	
total	97	164	99	1274	1,634 (100.0)	0.001‡
Lymphocyte count:						
increased	3 (3.0)	2 (1.0)	1 (1.0)	9 (1.0)	15 (1.0)	
normal	89 (90.0)	149 (91.0)	72 (72.0)	1,040 (81.0)	1,350 (82.0)	
decreased	7 (7.0)	13 (8.0)	27 (27.0)	225 (18.0)	272 (17.0)	
total	99	164	100	1,274	1,637 (100.0)	0.001†
Creatinine:						
increased	6 (6.0)	29 (18.0)	34 (34.0)	45 (4.0)	114 (7.0)	
not increased	92 (94.0)	135 (82.0)	65 (66.0)	1229 (96.0)	1521 (93.0)	
total	98	164	99	1274	1635 (100.0)	0.001‡
Evaluation by the physician:						
well nourished	18 (78.0)	81 (49.0)	45 (45.0)	ND§	144 (50.0)	
risk of malnutrition	5 (22.0)	71 (43.0)	41 (41.0)	ND	117 (41.0)	
malnutrition	–	12 (8.0)	14 (14.0)	ND	26 (9.0)	
total	23	164	100	ND	287 (100.0)	0.008†

*Hospital 1 – Sisters of Mercy University Hospital, Zagreb; Hospital 2 – University Hospital for Tumors, Zagreb; Hospital 3 – Zagreb University Hospital Center; Hospital 4 – Rijeka University Hospital Center.
†Kruskal-Wallis test.
‡Chi-square test.
§ND, not done.

Table 4. Correlation coefficients of the analyzed parameters and the screening score in the four hospitals*

	Hospitals (correlation coefficient)†				
Parameter	all	1	2	3	4
A (reduced food intake)	0.651‡	0.521‡	0.789‡	0.841‡	0.572‡
B (weight loss)	0.761‡	0.766‡	0.884‡	0.854‡	0.711‡
C (BMI)	0.283‡	0.145	0.239‡	0.534‡	0.204‡
D	0.747‡	0.498‡	0.756‡	0.810‡	0.740‡
E	0.749‡	0.815‡	0.241‡	0.671‡	0.795‡
Albumin	0.214‡	0.050	0.350‡	0.461‡	0.291‡
Urea	-0.017	0.248†	-0.063	-0.516‡	0.070†
Lymphocytes	0.234‡	0.021	0.240‡	-0.306‡	0.260‡
Creatinine	-0.049†	0.059	-0.252‡	-0.502‡	0.108‡
Total evaluation	-0.771‡	-0.334	-0.777‡	-0.825‡	ND

*Hospital 1 – Sisters of Mercy University Hospital, Zagreb; Hospital 2 – University Hospital for Tumors, Zagreb; Hospital 3 – Zagreb University Hospital Center; Hospital 4 – Rijeka University Hospital Center.
†Correlation coefficient (Spearman-rho) significant at the 0.05 level (2-tailed).
‡Correlation coefficient (Spearman-Rho) significant at the 0.01 level (2-tailed).

in Hospital 2, and 45% in Hospital 3. The proportion of patients at the risk of malnutrition was 22% in Hospital 1, 43% in Hospital 2, and 41% in Hospital 3. No patients were described as malnourished in Hospital 1, as opposed to 8% and 14% in Hospitals 2 and 3, respectively. There were significant differences among these three Hospitals in nourishment status of the patients ($p = 0.008$).

Comparison of Hospitals

Comparative analysis of Hospitals 1, 3, and 4 showed significant differences among them in all parameters but sex distribution ($p = 0.695$) and surgical intervention types ($p = 0.068$). Hospitals 1, 2, and 4 also significantly differed in almost all parameters except in patient weight ($p = 0.087$), BMI ($p = 0.230$), and blood urea concentration ($p = 0.123$). Finally, comparison between Hospital 1 and Hospital 4 did not reveal any statistical difference in the majority of the parameters, except in weight loss during the last few months ($p<0.001$), estimated period of perioperative fasting ($p = 0.001$), albumin blood concentration ($p = 0.001$), and lymphocyte counts ($p = 0.002$). These results indicated that patients in these two Hospitals were very similar in most of the analyzed parameters. Moreover, the fact that over 80% of patients at these two Hospitals also had malnutrition score ≥8 showed that these two hospitals had proportionally more well-nourished patients.

Correlation between Patient Parameters and Screening Score

The correlation between patient parameters and nutrition assessment screening scores were presented as common correlation coefficient values (r) for all hospitals together and each hospital separately. Correlation coefficient analysis suggested that the following parameters correlated positively with the screening score: weight loss during the last several months ($r = 0.761$), complexity of surgical intervention or, in oncologic patients, additional stress anticipated ($r = 0.749$), perioperative fasting or underlying oncologic disease ($r = 0.747$) and reduced food intake ($r = 0.651$). Overall patient nutritional status evaluation by the physician showed negative correlation with screening score ($r = -0.771$). BMI ($r = 0.283$) and laboratory biochemical parameters, such as albumin ($r = 0.214$), lymphocyte count ($r = 0.234$), and creatinine ($r = -0.049$), showed mild correlation with the screening score. The lowest correlation value was found for urea ($r = -0.017$).

Discussion

Malnutrition is a state produced by insufficient intake of macronutrients (protein-energy undernutrition, or vitamin and mineral deficiency), excessive intake of macronutrients (obesity), or excessive intake of inappropriate substances, such as alcohol (1-3). Many hospitalized patients are malnourished, and the relationship between malnutrition, disease, and additional complications is well established (3). Consequently, in contrast to well-nourished and normal-weight patients, the malnourished ones are more likely to stay longer in hospital due to further complications. Nutritional interventions may lower the rate and intensity of treatment complications and the number of hospital readmissions on the one hand, and improve quality of life and treatment outcome on the other. Therefore, it is important to identify malnourished patients as well as those at nutritional risk. Nutritional screening is the process of discovering characteristics or risk factors known to be associated with dietary problems. Its main purpose is to identify individuals who are at risk. As opposed to the more time-consuming and detailed process of nutritional assessment, screening should be a simple procedure aimed at identifying the nutritional status in an expedient manner. Nutritional assessment is a comprehensive process of identifying individuals and populations at risk and of planning, implementing, and evaluating a course of action (2-9).

The evaluation of nutritional status is a complex matter and for it to be of clinical importance the ideal method should be able to predict whether an individual would have increased morbidity and mortality rates in the absence of nutritional support. Moreover, disease and nutrition interact in such a way that the disease may cause secondary malnutrition or that malnutrition may adversely influence the underlying disease. In fact, patient outcomes are multifactorial. Despite repeated attempts by investigators to devise tools for assessing patient nutritional status, no single tool to date has been universally accepted (2-9). A recently published screening system by Kondrup et al (14) during the preparation of this study, which was validated against published randomized controlled trials, seems to be able to distinguish between trials with a positive effect versus those with no effect.

We performed nutritional assessment of 1,639 patients using our nutritional screening questionnaire. The comparison of patients at four hospitals revealed differences, which probably reflected the extent and nature of their diseases and, consequently, of their planned treatment. Patients in Hospitals 1 and 4 were quite similar. When these two hospitals were compared with Hospital 3, it seemed that they had less patients scheduled for major surgical interventions. On the other hand, patients from Hospital 2 were more similar to patients in Hospital 3 than to those at the other two hospitals. Since there were over

a thousand patients in Hospital 4, ie 10-12 times more than in other three hospitals, the mean values were undoubtedly influenced by the values from Hospital 4, which actually contributed about 80% of the patients. This unplanned difference in the number of patients per hospital appeared because larger numbers of patients than expected could be screened at Hospital 4. Since the aim of our study was to make a cross-sectional study of patients' nourishment status our decision was to perform the study with all data in spite of this quantitative heterogeneity among the hospitals. As a consequence, not only the results from oncologic Hospital 2 but also from Hospital 3 "disappeared" in the total result that included all four hospitals. Therefore, we additionally analyzed all results separately for each hospital. We were thought that when having as initially "expected" a comparably (smaller) sample size at Hospital 4, we would probably obtain the same results but with a broader variance. Having in mind the limitation of our study due to the heterogeneic distribution of patients per site, the obtained results suggested that 373 (23%) patients altogether had screening score ≤7, ie, could be described as at risk of malnutrition or as being malnourished. The number of patients evaluated by physicians was smaller (n = 278) and 50% of them were described as malnourished or as being at the risk of malnutrition. The discrepancy between these two values (23% vs 50%) is probably due to the fact that almost all patients, who were evaluated by physicians, came from Hospitals 2 and 3, which, according to the obtained data, had more seriously ill patients. Moreover, at these two hospitals the screening score value ≤7 was found in 42% and 64% of the patients, respectively.

A correlation analysis between the screening score value ≤7, and the BMI and four laboratory parameters suggested that these parameters were probably not useful in predicting malnourishment or the risk of malnourishment. However, we are also aware that this correlation analysis does not validate our screening tool, since that would require some external comparison, e.g. with another independent tool or with respect to clinical outcome. As a parameter, BMI seems more appropriate for establishing overweight than underweight (3,7). This is probably due to the prevalence of normal and overweight persons in developed countries. A recently published field study conducted in Croatia between 1995 and 1997, which included approximately 10,000 adult volunteers from 30 randomly selected settlements in all of the 21 Croatian Counties, showed that as many as 79.2% of men and 49.9% of women had BMI values of over 25 (15). Furthermore, this BMI value was positively related to age. This high obesity rate in Croatia is most probably related to the dietary and physical activity patterns, which affect the nutritional status of the population (15).

Albumin, urea, lymphocyte count, and creatinine, which were used as laboratory parameters in our questionnaire, were easily obtained since they are routinely determined in hospitalized patients. Although these parameters in the presence of a normal renal function and fluid intake might reflect protein-energy malnutrition and/or lean body (muscle) catabolism, they are also affected by other conditions and diseases. In general, laboratory parameter values reflect the net result of the synthesis, distribution, and loss or excretion. Therefore, since their values may be affected by medically-induced causes other than nutrition, they may be of limited use in nutrition assessment (7,8,10,12,16). Similarly, total lymphocyte count is an indicator of the immune status. However, it is generally not a good indicator of the nutritional status (7,8,10,16,17).

The following five parameters correlated relatively well with the screening score value ≤7: body weight loss, appetite loss, estimated period of perioperative fasting (for patients from Hospitals 1, 3, and 4) or the status of the underlying oncologic disease (Hospital 2), categorization of the surgical procedure (Hospitals 1, 3, and 4), or additional stress expected (Hospital 2), and the patient's overall evaluation by anesthesiologist or ward physician.

The weight status seemed to be the outcome parameter the most relied upon in assessing the nutritional status of patients and the consequences of significant weight loss predisposing the patient to malnutrition have been well documented (2,3,7,8). Weight loss in patients with a tumor burden independently affects morbidity and mortality. Pre-illness weight is an important component of the overall nutritional perception of a person. Weight changes, correlating most strongly with nutritional status, need to be considered in the time context. An involuntary weight loss of 5% during the previous 3 months or weight change by 10% or more during the previous 6 months also place the patient in the high-risk category (2,3,7,8). The weight status is also influenced by edema, ascites, and the hydration status. Drugs or medications that may influence the weight and/or hydration status should also be evaluated for their effect on the patient's weight. For example, medications that result in edema or fluid retention, such as steroids, may give a false impression of weight status and lead the clinician to an incorrect assumption (2,3,7,8). On the other hand, in some patients it might be difficult to determine the true weight loss or they might be unaware of their weight loss. Therefore, some patients would be missed (2,3,7,8).

Decline of eating (anorexia) is relatively common among cancer patients (2,3,7,8,16,18,19). Anorexia leading to cachexia may be present early in the course of the disease and remain a symptom of tumor activity or a result of the antineoplastic therapy. Anorexia may also develop after the diagnosis has been made. This may be an emotional response to the fear and anxiety experienced by individuals confronted with such a life-threatening illness. Moreover, tumors in the gastrointestinal tract may obstruct the passage of nutrients or limit the patient's eating ability (16,18-20).

The results obtained by using the above parameters indicate that these parameters might be sufficient for malnutrition screening. Moreover, the health care staff should be able to obtain answers to the first two questions (body weight and appetite loss) without any

problem. Therefore, for fast malnutrition screening performed within 24 h of hospital admission only these two questions can be used. Patients under suspicion of malnutrition should then undergo a more detailed malnutrition assessment by physicians in order to identify whether they are malnourished and to determine the most appropriate form of nutrition support (1,2,4,5,9,16).

The results obtained in the study performed in Croatia correspond with those obtained by the so called "Hackl score" (21), which is frequently used in nutrition evaluation in Austrian hospitals. Moreover, the results obtained by Ferguson et al (9) indicate that for the initial nutritional screening, questions on weight loss, how much weight loss, and decreased appetite are sufficient and reliable. Also, the screening system of Kondrup et al (14) is based on recent percentage weight loss, body mass index, recent change in food intake, and the severity of disease.

The final validation of our screening questionnaire would require an adequate prospective study and/or a parallel comparison with some other malnutrition screening tools, such as subjective global assessment tool, which encompasses historical, symptomatic, and physical parameters. In that respect, we have started a prospective study in patients considered to be at risk of malnutrition.

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