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USE OF NUTRITIONAL STATUS SCREENING TESTS IN EVALUATION OF MALNUTRITION OF ONCOLOGICAL PATIENTS

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SUMMARY

INTRODUCTION: Malnutrition is a common problem in cancer patients. It is well established that malnourished cancer patients have increased risks of morbidity and mortality when undergoing surgical procedures. It is also established that by increasing the lean body mass, these complications can be reduced. The role of nutrition in mitigating the surgical complications linked to the preoperative state of malnutrition, however, has not been well defined. Thus, the indications for using parenteral or enteral nutrition in the management of the cancer patient are not clearly established.

OBJECTIVE: To determine and evaluate malnutrition of oncological patients using nutritional status screening tests. To determine the usefulness of determining the nutritional status of patients on admission to hospital.

PATIENTS AND METHODS: A total of 739 patients, with pathohistological verified malignancy, were evaluated to determine individual nutritional status using the Nutrition Risk Screening (NRS) 2002, Malnutrition Universal Screening Tool (MUST) and Mini Nutritional Assessment (MNA) questionnaires. Enrolled patients were hospitalized in the Clinical Centre University of Sarajevo and the study was performed during a period of four years (2006-2010).

RESULTS: In patients with pathohistological verified malignancy (n = 739), more than 60 % were nutritive deficient, according to all three evaluated tests. There were significantly more patients in malnutrition with BMI < 20% and with BMI 20-25% in all three tests ($p < 0.001$).

There were significantly more patients with malnutrition with serum albumin level <35 g/l ($p<0.001$), and no significant malnutrition in patients with albumin level >35 g/l.

CONCLUSIONS: Cancer patients have major risk of malnutrition. More than 60% had moderate or severe malnutrition. NRS 2002, MUST and MNA are useful and simple tools for evaluating the nutritional status. Nutritional evaluation of cancer patients needs to be improved so as to offer better treatment of symptoms and to improve the patient's quality of life. It should also be used as a routine assessment on admission to hospital.

KEYWORDS: *oncology, malnutrition, tests*

PRIMJENA PROBIRNIH TESTOVA NUTRITIVNOG STATUSA ZA PROCJENU POTHRANJENOSTI ONKOLOŠKIH BOLESNIKA

SAŽETAK

UVOD. Pothranjenost je česta pojava u onkoloških bolesnika. Dobro je poznato da su pothranjeni bolesnici s rakom pri kirurškim zahvatima izloženi povećanom riziku pobola i smrtnosti. Također je poznato da je povećanjem tjelesne mase bez masnog tkiva te komplikacije moguće umanjiti. Međutim, još nije točno utvrđeno koja je uloga prehrane u smanjenju kirurških komplikacija povezanih sa stanjem pothranjenosti prije operacije, pa stoga nisu jasno utvrđene ni indikacije za primjenu parenteralne ili enteralne prehrane u zbrinjavanju bolesnika s rakom.

CILJ. Utvrditi i procijeniti pothranjenost onkoloških bolesnika primjenom probirnih testova nutritivnog statusa; utvrditi korisnost određivanja nutritivnog statusa bolesnika pri primitku u bolnicu.

BOLESNICI I METODE. Primjenom upitnika za probir nutritivnog rizika - NRS 2002 (od eng. Nutrition Risk Screening), univerzalnog obrasca za procjenu pothranjenosti - MUST (od eng. Malnutrition Universal Screening Tool) i mini

procjenu nutritivnog statusa - MNA (od eng. Mini Nutritional Assessment) procijenjeno je ukupno 739 bolesnika s patohistološki potvrđenom zloćudnom bolešću kako bi se utvrdio nutritivni status pojedinog bolesnika. Ispitivanje se provodilo tijekom četverogodišnjeg razdoblja (2006.-2010.) na bolesnicima koji su bili hospitalizirani u Kliničkom centru Sveučilišta u Sarajevu.

REZULTATI. Rezultati sva tri testa pokazala su da je među bolesnicima s patohistološki potvrđenom zloćudnom bolešću (n = 739) više od 60% nedostatno uhranjeno. Sva tri testa pokazala su da je značajno veći broj pothranjenih među bolesnicima s indeksom tjelesne mase ITM< 20% i ITM 20-25% (p< 0,001)

Značajno je veći broj pothranjenih bio među bolesnicima u kojih je vrijednost albumina u serumu iznosila <35 g/l (p<0,001), dok pothranjenost u bolesnika u kojih je vrijednost albumina iznosila >35 g/l nije bila statistički značajna.

ZAKLJUČCI. U bolesnika s rakom pothranjenost predstavlja velik rizik. U više od 60% uočen je umjereni ili težak oblik pothranjenosti. NRS 2002, MUST i MNA korisni su i jednostavni obrasci za procjenu nutritivnog statusa. Procjenu nutritivnog statusa bolesnika s rakom potrebno je poboljšati kako bi se omogućilo bolje liječenje simptoma i bolesnicima poboljšala kvaliteta života. To bi također trebala postati rutinska pretraga pri primitku bolesnika u bolnicu.

KLJUČNE RIJEČI: *onkologija, pothranjenost, testovi*

INTRODUCTION

Malnutrition is a common problem in cancer patients. Many factors contribute to weight loss: some of them can be related to diminished dietary intake, while others are more associated with metabolic changes induced by systemic inflammatory responses. This is why at a specific phase during the course of development, some cancers will benefit from nutritional support, while in theory, others will benefit from anti-inflammatory treatment. Parenteral nutrition is indicated for severe malnourished surgical patients and for allogenic stem cell transplant patients. Tube feeding (enteral nutrition) should be considered for patients with a functional gut who are unable to ingest sufficient nutrients orally, for example head and neck cancer patients. The value of dietary counseling and oral nutritional support has not been proven in patients undergoing chemotherapy, which is why it is so difficult to propose recommendations. Some arguments seem to favor parenteral nutrition for patients with bowel obstruction suffering from advanced-stage incurable cancer.

It is well established that malnourished cancer patients harbor increased risks of morbidity and mortality when undergoing major surgical procedures (1). It is also established that by increasing the lean body mass, these complications can be reduced. The role of nutrition in mitigating the surgical complications linked to the preoperative state of malnutrition, however, has not been well defined. Thus, the indications for using parenteral or enteral nutrition in the management of the cancer patient are not clearly established (2).

The judicious use of nutritional supplementation principally requires the correct identification of the severely malnourished patient who may benefit from added caloric intake (3). When this identification is made preoperatively and the patient is scheduled for a major surgical procedure, it is likely that the patient will benefit from preoperative nutrition. If the patient is only modestly malnourished, nutritional supplementation can be delivered postoperatively for an appropriate length of time with defined endpoints.

Screening tools are designed to detect protein and energy undernutrition and/or to predict whether undernutrition is likely to develop or worsen under the present and future conditions of the patient or client. Therefore, screening tools embody the following 4 main principles:

1. *Actual condition?* Height and weight allow calculation of BMI. Ranges for BMI are as follows: normal, 20–25; obesity, >30; borderline underweight, 18.5–20; and undernutrition, <18.5. In cases where it is not possible to obtain height and weight, e.g., in some severely ill patients, a useful surrogate may be mid-arm circumference, measured at the upper-arm midway between the acromion and the olecranon. This can be related to centiles of tables for the particular population, age, and sex (4) BMI may be less useful in growing children and adolescents, and in the very elderly. Nevertheless, the BMI in general provides the best overall accepted measure of weight for height.

2. *Is the condition stable?* Recent weight loss is obtained from the patient's history, or even better, from previous measurements in medical records. More than 5% involuntary weight loss for 3 months

is usually regarded as significant. This may reveal undernutrition that was not discovered by measurement of height and weight or BMI, e.g., weight loss in obesity. Weight loss may also predict further nutritional deterioration (4,5).

3. *Will the condition worsen?* This question may be answered by asking whether food intake has been decreased up to the time of screening and if so by approximately how much and for how long. Confirmatory measurements can be made of the patient's food intake in hospital or by food diary. If these measurements are found to be less than the patient's requirements with normal intake, then further weight loss is likely.

4. *Will the disease process accelerate nutritional deterioration?* In addition to decreasing appetite, the disease process may increase nutritional requirements due to the stress metabolism associated with severe disease (e.g., major surgery, sepsis, and multitrauma), causing nutritional status to worsen more rapidly or to develop rapidly from fairly normal states (4, 6-10).

Variables 1–3 should be included in all screening tools, whereas the fourth variable is relevant mainly in the hospital setting. In screening tools, each variable should be given a score, thereby quantifying the degree of risk and allowing a direct link to a defined course of action.

PATIENTS AND METHODS

A total of 739 patients, with verified malignancy, were evaluated to determine individual nutritional status using the Nutrition Risk Screening (NRS) 2002 (11), Malnutrition Universal Screening Tool (MUST) (12,13) and Mini Nutritional Assessment (MNA) (14,15) questionnaires.

This study was performed in a four-year period (2006–2010), among hospitalized patients in the Clinical Centre University of Sarajevo.

This was a prospective, descriptive study. The study was observational, created to evaluate the nutritional status of oncology patients, with no repercussion on patients' treatment and therapy. All patients signed a written consent form for enrollment into the study. The study was created according the rules of GCP and GLP.

Eligible patients were required to have patohistologically verified malignant disease.

All patients were older than 18 years of age, and had been hospitalized.

Patients who were in the recovery period after surgical or chemo treatment, had verified HIV infection or were in a moribund state, were not enrolled.

Demographic data were presented in tables and X^2- test was used. Prevalence was calculated using the number of verified hospital malnutrition patients among all hospitalized patients at the Clinical Centre University of Sarajevo during 2006-2010. All data are presented in tables of contingence, $p < 0.05$.

Statistical analysis was performed using: X^2-test – a nonparametric test for two groups comparing an observed and expected frequency, model X^2-test - a nonparametric test for testing homogeneity of two samples with the frequencies allocated in 2 x 2 tables, and the rank-sum test for two independent samples (Mann Whitney).

RESULTS

The demographic structure of enrolled patients with pathohistologically verified malignancy (n=739), is presented in Table 1. Types of malignant diseases and prevalence of malnutrition of enrolled patients are presented in Table 2.

There were no statistically significant differences in gender and age of the studied patients (Table 1).

Table 3 shows that there were significantly more patients with malnutrition with BMI <20% and BMI 20-25% in all three tests ($p< 0.001$).

Among patients with BMI >25 there were significantly more patients with malnutrition, and

Table 1.

DEMOGRAPHIC STRUCTURE OF PATIENTS (N = 739)

Total	730
• Male	438 (59.3%)
• Female	301 (40.7%)
Age (X ± SD)	61.6 ± 16.4
• Male	62.5 ± 16.1
• Female	60.1 ± 16.6
Median	62
• Male	63.5
• Female	60.0
Mann-Whitney Rank Sum Test	p = 0.149

Table 2.

TYPES OF MALIGNANT DISEASES AND PREVALENCE OF MALNUTRITION ACCORDING TO MUST, MNA AND NRS-2002 IN THE ENROLLED PATIENTS (N=739)

Malignancy	N	Malnutrition		
		MUST (66.3%)	MNA (71.5%)	NRS-2002 (67.1%)
Esophageal Carcinoma	103 (14%)	68	73	69
Gastric adenocarcinoma	118 (16%)	78	84	79
Hepatocellular carcinoma	81 (11%)	54	58	55
Pancreatic tumors	96 (13%)	64	69	65
Hematological tumors	141 (19%)	93	100	95
Colorectal adenocarcinoma	200 (27%)	132	143	134

Table 3.

BMI IN CORRELATION WITH MALNUTRITION CALCULATED ACCORDING TO MUST, MNA AND NRS-2002 (N=739)

BMI	MUST	MNA	NRS-2002
	Malnutrition (n)		
<20 (n=227)	n=203 (p<0.001)	n=210 (p<0.001)	n=201 (p<0.001)
20-25 (n=378)	n=263 (p<0.001)	n=289 (p<0.001)	n=254 (p<0.001)
>25 (n=134)	79 (p=0.005)	82 (p<0.001)	76 (p=0.038)

Table 4.

ALBUMIN SERUM LEVEL IN CORRELATION WITH MALNUTRITION CALCULATED ACCORDING TO MUST, MNA AND NRS-2002 (N=739)

Albumin serum level	MUST	MNA	NRS-2002
	Malnutrition (n)		
<34.99 g/l (n=615)	n=442 (p<0.001)	n=481 (p<0.001)	n=453 (p<0.001)
>35.0 g/l (n=124)	n=67 (p = 0.253)	n=70 (p = 0.057)	n=59 (p = 0.525)

the result of all three tests was statistically significant ($p < 0.05$).

Table 4 shows there were significantly more malnourished patients with serum albumin level <35 g/l ($p<0.001$), and no significant malnutrition was reported in patients with albumin level >35 g/l.

DISCUSSION

While signs of cancer cachexia, such as weight loss, are generally easy to assess, it is difficult to determine precisely which patients will truly benefit from a preoperative course of enteral or parenteral nutrition prior to surgical resection of their tumor. Weight loss is defined by the American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines as loss of >10% of pre-illness weight (16). Protein calorie malnutrition has been assessed through the use of objective measurements, including serum albumin levels, weight, anthropomorphic measurements, grip strength, and indices such as the body mass index in nutritional risk index. Unfortunately, no single measurement is sensitive and specific for the identification of malnutrition.

Because our decisions are now largely based on clinical trials that have been performed and published, it is reasonable to attempt to use the same criteria promulgated in these trials to assess the cancer patient. Whereas the simplest way to screen patients for malnutrition may be to determine the occurrence and degree of unintentional weight loss, more objective means are now available. Generally, most hospitals now have nutritional assessment teams that are highly capable of assessing the nutritional risk of the cancer patient requiring surgical intervention. The nutritional risk index is an example of one published method for determining the degree of malnutrition present in the preoperative patient.

Once it was clear that virtually all patients could be fed intravenously or enterally, the question was raised as to which patients will truly benefit from supplemental nutrition (3, 17). The completion of several randomized clinical trials led to the conclusion that there are several specific established indications for the use of nutritional support (18).

Other cancer patients who will likely benefit from nutritional support include the severely malnourished cancer patient undergoing a major extirpative procedure such as an esophageal resection, the moderately malnourished cancer patient who will be unable to eat for more than 7 to 10 days following their surgical procedure, and the patient undergoing chemotherapy with complications precluding oral intake. There is a research which also suggested that patients with immunosuppression may benefit from nutritional manipulation (19).

The Veterans Affairs Total Parenteral Nutrition Cooperative Study Group (20) demonstrated that the use of preoperative total parenteral nutrition should be limited to patients who are severely malnourished. In patients with documented severe malnutrition, intravenous nutrition delivered 7 to 15 days before surgery resulted in fewer noninfectious complications than in control populations not receiving nutrition (5% vs. 43%, p=0.03). Patients with mild or moderate degrees of malnutrition showed no benefit to preoperative nutritional supplementation. Two additional randomized trials (21,22) and one meta-analysis (23) confirmed that only patients with severe malnutrition, generally defined as having weight losses greater than 10% to 15% or albumin levels <2.8 g/dl, will benefit from preoperative nutrition.

The decision to institute postoperative nutrition is generally more empirical and is based on clinical judgment of the surgeon. It is a common practice to plan for postoperative enteral or parenteral nutrition for the patient in whom oral intake is not possible for more than 7 to 10 days following surgery. Similarly, it is common to institute nutritional support in the postoperative period when the patient has been without oral intake for more than 10 days and is expected to continue in this state for a prolonged period of time. The basis for these decisions can be related to studies where surgical outcome has been adversely affected in patients who were unable to eat for more than 14 days.

From a practical perspective, Copeland (24) has identified the following guidelines for intravenous nutrition in cancer patients: 1. Patients who meet the criteria for malnutrition and have a reasonable chance of responding to appropriate oncologic therapy, 2. patients who have been previously treated with oncologic therapy yet are incapable of adequate enteral nutrition because of malnutrition imposed by the therapy, and 3. clinically nourished patients whose treatment plan necessitates multiple courses of chemotherapy, radiotherapy, or surgery, when optimal nutritional status must be maintained as a treatment goal. Further studies have suggested a proactive approach to nutritional assessment and supplementation (2).

Nutrition Risk Screening (NRS) 2002 was established by using a retrospective analysis of controlled trials and the nutritional criteria or characteristics and clinical outcome. The system was developed on the assumption that the indications for nutritional support are the severity of undernutrition and the increase in nutritional requirements, resulting from the disease, the severe undernutrition or severe disease by themselves or in varying combinations may indicate the need for nutritional support. This will also include patients who are not undernourished at the time but are at risk of becoming so because of disease and/or its treatment, major trauma, surgery, or chemotherapy, since both may cause impairment of food intake and increased stress metabolism. The concept of relating nutritional status to severity of disease is well recognized, as displayed for example in the decision box, which emphasizes the need for acting on possible further impairment of nutritional status during the clinical course of the disease. These concepts are illustrated both by the study of Müller et al (25) which showed that the positive effect of perioperative nutritional support disappeared when the surgical technique was changed from a transthoracic procedure to a less-invasive stapling procedure.

This screening system, which was designed to include measures of current potential undernutrition and disease severity, was then validated against all controlled trials of nutritional support in order to evaluate whether it was capable of distinguishing those with a positive clinical outcome from those that showed no benefit from nutritional support. The analysis and the recommendations were reviewed and discussed with an ESPEN ad hoc working group under the auspices of the ESPEN Educational Committee.

The purpose of the NRS 2002 system is to detect the presence of undernutrition and the risk of developing undernutrition in the hospital setting (26, 27). The NRS 2002 system contains the nutri-

tional components of Malnutrition Universal Screening Tool (MUST), and in addition, a grading of severity of disease as a reflection of increased nutritional requirements. It includes four questions as a prescreening for departments with few at-risk patients. With the prototypes for severity of disease given, it is meant to cover all possible patient categories in a hospital. A patient with a particular diagnosis does not always belong to the same category.

Nutritional support of the surgical oncology patient is now possible on many different levels. Technology has evolved to permit parenteral and enteral support in a majority of patients (28). The principal questions are which patients will truly benefit from enteral support, when the support should be delivered, and by what route.

CONCLUSION

Cancer patients are at high risk of malnutrition. More than 60% have moderate or severe malnutrition. NRS 2002, MUST and MNA are useful and simple tools for evaluating the nutritional status. Nutritional evaluation of cancer patients needs to be improved so as to offer better treatment of symptoms and improve the patient's quality of life. It should also be used as a routine assessment on admission to hospital.

REFERENCES

1. Ottery FD. Supportive nutrition to prevent cachexia and improve quality of life. Semin Oncol 1995;22: 98-111.
2. McMahon K, Decker G, Ottery FD. Integrating proactive nutritional assessment in clinical practices to prevent complications and cost. Semin Oncol 1998;25: 20-7.
3. Ottery FD. Definition of standardized nutritional assessment and interventional pathways in oncology. Nutrition 1996; 12(1 suppl):S15-S19.
4. Keller HH, Ostbye T. Nutritional risk and time to death; predictive validity of SCREEN (Seniors in the Community Risk Evaluation for Eating and Nutrition) J Nutr Health Aging 2003;7(4):274–9.
5. Gazzotti C, Albert A, Pepinster A et al. Clinical usefulness of the mini –nutritional assessment (MNA) scale in geriatric medicine. J Nutr Health Aging 2000; 4: 176-81.
6. Beck AM, Ovesen L, Schroll M. Home-made oral supplement as nutritional support of old nursing home residents, who are undernourished or at risk of undernutrition based on the MNA. A pilot trial. Aging Clin Exp Res 2002;14:212-5.
7. Jensen GL, Mirtallo J, Compher C, et al. Adult starvation and disease-related malnutrition: a proposal for etiology-based diagnosis in the clinical practice setting from the International Consensus Guideline Committee. Clin Nutri 2010; 3(487):271-3.
8. Stratton RJ, Elia M. Deprivation linked to malnutrition risk and mortality in hospital. Br J Nutr 2006;96(5): 870–6.
9. Stratton RJ, Elia M. Who benefits from nutritional support: what is the evidence? Eur J Gastroenterol Hepatol. 2007;19(5):353–8.
10. Bozzetti F, Gavazzi C, Miceli R et al. Perioperative total parenteral nutrition in malnourished gastrointestinal cancer patients: a randomised clinical trial. J Parent Enter Nutr 2000; 24:7-14.
11. Kondrup J, Rasmussen HH, Hamberg O et al. Nutritional Risk Screening (NRS 2002): a new method based on an analysis of controlled clinical trials. Clin Nutr 2003; 22:321-36.
12. Malnutrition Advisory Group (MAG). MAG – Guidelines for Detection and Management of Malnutrition. British Association for Parenteral and Enteral Nutrition, 2000, Redditch, UK
13. BAPEN. First published May 2004 by MAG the Malnutrition Advisory Group, a Standing Committee of BAPEN. Reviewed and reprinted with minor changes March 2008 and September 2010 'MUST' is supported by the British Dietetic Association, the Royal College of Nursing and the Registered Nursing Home Association.
14. Vellas B, Guigoz y, Garry PJ et al. The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. Nutrition 1999;15: 116-22.
15. Beck AM, Ovesen L, Osler M. The Mini Nutritional Assessment (MNA) and the Determine Your Nutritional Health Checklist (NSI Checklist) as predictors of morbidity and mortality in an elderly Danish population. Br J Nutr 1999;81:31-6.
16. Guidelines for the use of parenteral and enteral nutrition in adult and pediatric patients. American Society for Parenteral and Enteral Nutrition. JPEN J Parenter Enteral Nutr 1993;17:1SA-52SA.
17. Wilmore DW. Catabolic illness: strategies for enhancing recovery. N Engl J Med 1991;325:695-702.
18. Souba WW. Nutritional support. N Engl J Med 1997; 336:41-8.
19. Lin CM, Abcouwer SF, Souba WW. Effect of dietary glutamate on chemotherapy-induced immunosuppression. Nutrition 1999;15:687-96.
20. Perioperative total parenteral nutrition in surgical patients. The Veterans Affairs Total Parenteral Nutrition Cooperative Study Group. N Engl J Med 1991;325: 525-32.

21. Souba WW. Nutritional support. N Engl J Med 1997; 336:41-8.
22. Fan ST, Lo CM, Lai EC, et al. Perioperative nutritional support in patients under-going hepatectomy for hepatocellular carcinoma. N Engl J Med. 1994;331: 1547-52.
23. Heyland DK, MacDonald S, Keefe L, et al. Total parenteral nutrition in the critically ill patient: a meta-analysis. JAMA. 1998; 280: 2013-9.
24. Copeland EM III. Historical perspective on nutritional support of cancer patients. CA Cancer J Clin. 1998; 48:67-8.
25. Muller JM, Thul P, Ablassmaier B. Perioperative nutritional therapy and its relevance for postoperative outcome. Chirurg 1997;68(6):574–82.
26. Kondrup J, Rasmussen HH, Hamberg O, Stanga Z. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. Clin Nutr 2003;22(3):321–36.
27. Whitby LG. Screening for disease: definitions and criteria. Lancet 1974;2(7884):819–22.
28. Koretz RL, Lipman TO, Klein S. AGA technical review on parenteral nutrition. Gastroenterology 2001;121: 970-1001.

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