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# Nutritional Assessment Tools for the Identification of Malnutrition and Nutritional Risk Associated with Cancer Treatment

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## ABSTRACT

Malnutrition and muscle wasting are common features of cancer cachexia that may interfere with the patient's response to cancer treatment, survival, and quality of life. An accurate nutritional screening at the time of diagnosis and throughout the patient's treatment fosters better control of the disease. Several screening tools have proven to be useful for this purpose. Nevertheless, nutritional evaluation is not a routine practice in this clinical setting and procedures must be standardized. Nutritional risk screening (NRS), malnutrition screening tool (MST), and patient-generated subjective global assessment (PG-SGA) are the most common screening tools, and each one possesses some benefits when screening patients for malnutrition; however, weight loss over a specific time period, dietary intake and anorexia must also be considered. The body mass index-adjusted weight loss grading system predicts survival. We recommend the application of MST or NRS, followed by PG-SGA, food intake determination, measurement of body weight, and its changes as well as body composition, biochemical nutritional markers, muscle function, and physical performance. (REV INVES CLIN. 2018;70:121-5)

**Key words:** Nutritional risk. Pelvic cancer. Radiotherapy. Chemotherapy. Malnutrition. Nutritional assessment.

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## INTRODUCTION

Malnutrition and muscle wasting are frequently observed in cancer patients, negatively compromise clinical outcomes and lead to prolonged hospital stays[1,2]. The most common causes are an increase in the energy and protein requirements resulting from the catabolic and physiologic effects of cancer cachexia, inadequate dietary intake and decreased physical activity[1].

The maintenance of adequate nutrition in cancer patients undergoing anticancer treatment represents a common challenge because of the many factors leading to malnutrition[3] which, in turn, may interfere with the patient's survival as a result of concomitant muscle wasting, pulmonary complications or an impaired immune response that increases susceptibility to infections. It is well known that cancer cachexia leads to significant weight loss due to a decreased fat mass and most importantly, to the loss of lean mass which correlates with a reduced possibility of survival. Even moderate weight loss (<5% of total body weight) can significantly worsen the patient's prognosis if afflicted by certain tumors. Furthermore, weight loss above 10% of the total baseline body weight leads to a decreased response to chemotherapy and a reduced survival rate[4].

Accurate nutritional screening involves the assessment of specific nutritional variables at the time of diagnosis and throughout the patient's treatment; therefore, responsibilities must be established; procedures must be standardized, and the process of quality control must be verified among the multidisciplinary team members treating cancer patients[1].

## NUTRITIONAL RISK SCREENING (NRS)

Nutritional screening must be efficient, brief, inexpensive, with high sensitivity, and good specificity[1,5]. The tools employed for this purpose include data obtained from the medical history, dietary intake, biochemical markers and, most importantly, anthropometric data[6]. Level of evidence A, strength of recommendation 1.

The use of nutritional screening is evidently necessary even when the nutritional risk is not overtly present since the impact of the early nutritional intervention on the quality of life of cancer patients has been proven. In addition, it is essential to evaluate thoroughly the nutritional status of patients during treatment, particularly, those undergoing radiotherapy or concomitant radiochemotherapy. It is certainly astonishing that, in spite of the frequency of malnutrition in this patient population, nutritional evaluation is not a routine practice in this clinical setting[6] Level of evidence B.

Nutritional screening must be completed at the time of diagnosis according to the guidelines established by the European Society for Clinical Nutrition and Metabolism[1], the Academy of Nutrition and Dietetics[7], and the American Society of Parenteral and Enteral Nutrition[8]. However, screening is not only required at diagnosis but also should be repeated the following month and again, 6 months later[1]. The most recommended tools for screening are the patient generated-subjective global assessment (PG-SGA)[6,9], the NRS[10], and malnutrition screening tool (MST)[11]. Level of evidence B, strength of recommendation 1.

The NRS is a tool developed under the assumption that nutritional support is warranted when severe malnutrition and increased nutritional requirements resulting from the disease are confirmed. NRS was validated in nutritional support trials conducted in hospitalized patients. It has also been used in cancer outpatients on diagnosis, as a flexible tool that only considers weight loss and food intake, both easily obtainable data that permit the evaluation of the patient's nutritional risk[10]. The MST is a brief and simple nutritional tool that has been validated in cancer outpatients undergoing radiotherapy and chemotherapy. It is based on patient recent weight loss and appetite loss; it is a strong predictor of nutritional risk and related to the PG-SGA (100% sensitivity, 92% specificity, 0.8 positive predictive value, and 1.0 negative predictive value)[12]. After applying the NRS or MST to cancer outpatients, the use of the PG-SGA is recommended since the latter includes a more thorough collection of data (anthropometric, biochemical, clinical, dietary variables, and those relating to cancer treatment, and comorbidities). This tool not only identifies nutritional risk but also data on the nutritional status that enables the subsequent monitoring of the patient. It is noteworthy to consider that the PG-SGA is recommended for

patients undergoing radiotherapy, so its use in patients undergoing concomitant radiochemotherapy[6] is inferred. Level of evidence B, strength of recommendation 1.

Likewise, it is very important to consider the patient's unintended weight loss over a given time period as part of the initial nutritional assessment and monitoring. A percentage of weight loss (% WL) that is cons (NRS) 10, significant at 3 months is 7.5%, and severe if >7.5%. Dietary intake must be simultaneously evaluated[13]. Level of evidence B, strength of recommendation 1.

## NUTRITIONAL ASSESSMENT

Once the cancer patient has been identified as being at risk of malnutrition through a screening tool, a complete nutritional evaluation must be performed by the dietitian[7]. The following procedure is recommended:

1. Evaluation of the dietary balance (energy and protein intake throughout the patient's history, nutrient deficiencies, or imbalances).

2. Evaluation of body weight, weight change, body mass index (BMI), and body composition.

3. Functional evaluation (skeletal muscle, immune, and cognitive) by dynamometry[14], delayed hypersensitivity tests, and physical performance using the WHO/Eastern Cooperative Oncology Group (ECOG) scale[15] and the Karnofsky performance status scale[16]. The walking speed test is also useful for the functional assessment of muscle mass.

4. Measurement of inflammatory molecules, including cytokines and C-reactive protein (CRP)[1].

Level of evidence A, strength of recommendation 1.

Regarding body weight, BMI and the prognosis in cancer patients, Martin et al. developed a cancer weight loss grading system that incorporates two dimensions: % WL and BMI, linking them to survival[17]. These authors used a 5 × 5 matrix analysis representing 25 possible combinations of % WL and BMI and combining groups with similar hazard ratios, they obtained five distinct grades with significantly different survival rates. A decrease in the survival gradient was evident when the % WL increased, and the BMI decreased; the highest risk was found in patients with a 15% of weight loss and a BMI <20 (Grade 4; median survival 4.3 months), and the lowest risk was found in patients with ≤2.5 of weight loss, and a BMI of 28 (Grade 0; median survival 20.9 months). Median survival time for Grade 1 was 14.6 months; for Grade 2, 10.8 months; and for Grade 3, 7.6 months. This BMI-adjusted weight loss grading system is a useful tool to predict survival since it is independent of the tumor location, stage or patient performance status, and it strongly discriminates survival differences[17]. Level of evidence B, strength of recommendation 2.

Body composition, and more specifically the relationship between adipose and lean tissues, has many clinical implications in cancer patients. Methods for evaluating human body composition have been developed and validated for research purposes focused on aging and chronic diseases. Dual-energy X-ray absorptiometry (DXA), magnetic resonance imaging (MRI) and computed tomography (CT) are considered the gold standard methods in the evaluation of human body composition. Bioelectrical impedance analysis (BIA) is an accessible method that has been commonly used to measure body composition in clinical populations, although it may not have the specificity and precision of DXA, MRI, and CT.

CT is clinically accessible and therefore, a very attractive resource when evaluating body composition in the cancer patient since it is a standard procedure in routine cancer patient care. CT offers great practicality as these images are undoubtedly of use in the patient's diagnostic workup and follow-up[18]. Level of evidence B, strength of recommendation 1

It is important to note that muscle mass measurement with bioelectrical impedance, DXA or CT[18], only reflects the amount of muscle mass, not its function. To evaluate muscle function, handgrip dynamometry, get up and test or walking speed tests should be performed[1,14,19]. Level of evidence B, strength of recommendation 1.

Anorexia is also an important factor to be evaluated in nutritional screening and nutritional assessment because cancer is considered a chronic disease.

Patients may display moderate or severe malnutrition when their energy intake is under 75% of their requirement over a month or more, and when the patient develops weight loss, muscle mass loss, fat mass loss or reduced muscular strength, generalized fluid accumulation, and signs of systemic inflammation[1,14]. Level of evidence A, strength of recommendation 1.

Biochemical markers classically used to evaluate nutritional status may be altered due to inflammation. However, it is recommended to measure albumin, pre-albumin, and transferrin, as mortality predictors. CRP can be measured as a marker of systemic inflammation[1]. Level of evidence A, strength of recommendation 1.

The presence of two or more of the following signs support a diagnosis of malnutrition[7]:

– Insufficient energy intake (<75% of the individual's requirement).

– Involuntary weight loss (>5% in 3 months).

– Loss of subcutaneous fat mass.

– Loss of muscle mass.

– Generalized edema (which may conceal weight loss).

– Reduction in grip strength.

Level of evidence B, strength of recommendation 1.

## CONCLUSIONS

Assessment of the nutritional risk and nutritional status of cancer patients is essential for optimal nutritional care. It is important to choose and validate the most accurate tools, as well as to monitor the nutritional status of patients to implement specific strategies toward improving their quality of life. In conclusion, and based on current available evidence, we suggest the following process for the assessment of nutritional risk and status:

1. Application of MST or NRS, followed by PG-SGA.

2. Assessment of energy intake and nutrient balance using the usual food intake recall and the food frequency questionnaires.

3. Measurement of body weight, assessment of weight change over a specific time period and BMI estimation.

4. Evaluation of body composition with CT, BIA, or DXA.

5. Measurement of biochemical and inflammation markers, such as transferrin, albumin, pre-albumin, CRP, and tumor necrosis factor-$\alpha$

6. Assessment of muscle function with the handgrip strength and walking speed tests.

7. Measurement of physical performance with the ECOG and Karnofsky scales.

The assessment of nutritional status of the cancer patient helps us understand the patient's condition; nonetheless, evidence on nutritional interventions by clinical trials is contradictory and inconclusive and will be thoroughly discussed later in this issue.

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