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DIFFICULTIES AND OPPORTUNITIES RELATED TO THE NUTRITION OF CANCER PATIENTS

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Summary
Introduction. The tumour and treatments have effects on metabolism, nutrition and thus the nutritional status.
Aim. To reveal nutritional difficulties leading to malnutrition, sarcopenia and to explore possibilities of dietetic intervention. To survey patients' nutritional status and malnutrition risk. Moreover, to assess patients' energy and nutrient intake and their nutrition habits regarding quantity and quality. The question of clinical nutrition was also raised.
Material and methods. Inpatients (64.33 years ± 18.62, 22 males/23 females) and outpatients (63.38 ± 16.08, 9 males/15 females) were involved, since patients should be provided with different dietetic services in these areas. Malnutrition risk screening was performed with NRS 2002. Nutritional status was determined based on measured anthropometric parameters and body composition analysis. Diet changes were measured by 3-day food diaries and 24-hour food recalls.
Results. All inpatients are at risk of malnutrition (60% moderately 12% severely). The decrease in muscle mass can be estimated based on calculated values. 16% of the outpatients are at risk of mild malnutrition and 8% had anorexia. 72% of the outpatients are overweight-obese, however, beside fat dominance, loss of muscle mass is also likely in 80%. Inpatients consumed 1,800 kcal, including supplementary feeding. 22% received supplementary formulas, still only 50-75% of the recommended amount is consumed. 41% of severe risk patients do not get ONS at all.
Conclusions. The nutritional status of cancer patients should be examined thoroughly. The provision of supplement formulas, tube or parenteral nutrition should be started timely.

Keywords: cancer, malnutrition, cachexia, sarcopenia, nutritional intake

INTRODUCTION

Cancer is now recognised as a chronic disease since the number of patients living with cancer is increasing. Developed treatments enhance survival rates significantly and also prolong lifetime (1).

Nutrition of cancer patients is vital from the diagnosis onwards. The risk of nutritional depletion is high for the following reasons. Due to the metabolic changes the tumour triggers, muscle wasting and weigh loss occur in patients (2). Symptoms and side effects, such as pain, stomach discomfort, diarrhoea, nausea, vomiting etc. patients usually suffer from, especially during treatment, might impair food intake, not to mention they may cause nutrient losses and may prevent nutrient absorption. The psychological effects, most often depression and anorexia, have a negative effect on appetite, consequently the energy and nutrient intake is much less than the desired amount. For all the above mentioned factors, the risk of weight loss and malnutrition is high. Approximately 40% of cancer patients have been found to have substantial protein energy malnutrition (3).

The role of malnutrition which increases morbidity and mortality in aging, as well as in patients with chronic diseases such as cancer, has been long recognized (4, 5). It is "a state resulting from the lack of uptake or intake of nutrition leading to altered body composition (decreased fat free mass) and body cell mass leading to diminished physical and mental function and impaired clinical outcome from disease" (6).

Furthermore, sarcopenia is a key feature of disease-related malnutrition. Currently the proposed criteria for sarcopenia assessment in a clinical setting include the determination of muscle mass, strength and physical performance (7). It is a syndrome characterised by progressive and generalised loss of skeletal muscle mass

and strength with a risk of adverse outcomes such as physical disability, poor quality of life and death. Diagnosis is based on the documentation of low muscle mass, low muscle strength and low physical performance (8).

Another factor is cachexia which is widely recognised in older adults as severe muscle wasting accompanying chronic diseases, such as cancer. Cachexia has recently been defined as a complex metabolic syndrome, associated with underlying illnesses and characterised by loss of muscle with or without the loss of fat mass (9, 10).

AIM

Our objectives were to reveal the nutritional difficulties of cancer patients leading to malnutrition and sarcopenia; and to explore the possibilities of dietetic interventions focusing on nutritional status, body composition assessment and malnutrition risk screening. Moreover, we wanted to prove that the results of validated risk screening methods should be complemented with complex nutritional status assessment and body composition analysis in order to explore muscle loss which plays an important role in cancer cachexia. We raised the question as to which patient is given clinical nutrition, such as formula-fed supplements (ONS), tube or parenteral feeding.

MATERIAL AND METHODS

The study was performed on 45 inpatients (23 females, 22 males) and 24 outpatients (15 females and 9 males) aged 64.33 years ± 18.62 and 63.38 ± 16.08 respectively.

A wide range of techniques can be used to assess body composition and malnutrition (11). However, we have selected the measuring methods which are also applied by dietitians in their daily clinical practice. First of all, body composition was measured by a 4-point OMRON BF 500 Bioimpedance analysis (BIA) device. Secondly, body weight was recorded in light clothing, standing barefoot on the machine. Thirdly, body height was measured separately, with the help of a wall-mounted stadiometer. The test itself is inexpensive, easy to use, readily reproducible and appropriate for both ambulatory and bedridden patients, although some clinical studies assume that BIA cannot reliably assess skeletal muscle mass in patients with body fluid abnormalities (12).

The estimation of skeletal muscle mass (SMM) was calculated with the equation of Lee et al. (body weight and height model). This equation was cross-validated with the independent samples of obese subjects. Prediction equations have been validated for multi-ethnic adults. The Lee et al. equation is the following:

SM (kg) = (0.244 x BW) + (7.80 x Ht) – (0.098 x age) + (6.6 x sex) + (race - 3.3)

BW in kg, Ht in m, sex = 1 for male and 0 for female, race = 1.2 for Asian, 1.4 for African American, and 0 for white or Hispanic (13).

Cut-off points depend on the chosen measurement technique and on the availability of reference studies as well. The EWGSOP recommends the use of normative (healthy young adults) rather than other predictive reference populations. The selection of measurement tools for research studies relies on availability and access to data for relevant reference populations (considering age, gender and ethnicity). Cut-off points can be used in case of skeletal muscle mass (SMM) and skeletal muscle mass index (SMI) (8).

According to ESPEN diagnostic measures are only needed for those patients who score positive for nutritional risk. In order to diagnose malnutrition there are two alternative ways:

- alternative 1: BMI < 18.5 kg/m^2,
- alternative 2: weight loss (unintentional) > 10% indefinite of time, or > 5% over the last 3 months combined with either BMI < 20 kg/m^2 if < 70 years of age, or < 22 kg/m^2 if ≥ 70 years of age or FFMI < 15 and < 17 kg/m^2 in women and men respectively (14).

Malnutrition risk screening was performed with the help of NRS 2002. The changes in diet were measured by validated 3-day food diaries and 24-hour food recalls. The energy and nutrient intake was compared to recommended necessities.

RESULTS

It is recommended by ESPEN that subjects at risk of malnutrition should be identified by validated screening tools, moreover should be assessed and treated accordingly. Based on the NRS 2002 scores all the clinical patients proved to be at risk of malnutrition: 28% mildly, 60% moderately and 12% severely. In case of the first two risk categories it is desired to rescreen patients weekly but if e.g. a major operation is scheduled, a preventive nutritional care plan is considered to avoid the associated risk status. However, if the Score is ≥ 3, a nutritional care plan is indicated and it should be initiated as early as possible. Regarding outpatients and their NRS 2002 Score, 16% was at risk of mild malnutrition.

As it is represented in table 1 19% of the clinical patients had low, 51% had normal, 18% had high and 12% had very high BMI. Among the outpatients 17% had low, 12% had normal, 46% had high and 25% had very high BMI.

The results of the BIA allowed us to distinguish between FFMI and FFM. FFMI data for men and women, respectively, were categorized as 'low' (< 17 kg/m^2 and < 15 kg/m^2). Low FFMI was found in16 (73%) male clinical and 6 (67%) male outpatients.

Cut-off values for FFMI were based on Swiss reference material, recommended by ESPEN. The latter offers a more precise description of the investigated

Table 1. Characteristics of the patients included in the study.

Data	Inpatients (n = 45) n; mean ± SD	Outpatients (n = 24) n; mean ± SD
Gender		
Men (n)	22	9
Women (n)	23	15
Age (years)	64.33 ± 18.62	63.38 ± 16.08
Body weight (kg)	68.35 ± 14.78	74.33 ± 16.03
Body height (cm)	168.57 ± 10.85	166.49 ± 10.91
BMI (kg/m^2)	24.00 ± 5.70 (n = 43)	26.83 ± 5.20
Underweight (n)	8	4
Normal weight (n)	22	3
Overweight (n)	8	11
Obese (n)	5	6
Body fat % – BF%		
Men	25.19 ± 0.11 (n = 16)	33.88 ± 12.87
Women	33.00 ± 0.09 (n = 12)	33.6 ± 9.29
Skeletal muscle % – SM%		
Men	–	40.23 ± 6.65
Women	–	26.60 ± 3.09
Fat mass – FM (kg)		
Men	15.25 ± 9.83 (n = 16)	30.83 ± 16.36
Women	24.07 ± 10.89 (n = 12)	23.65 ± 9.5
NRS 2002 score	3.16 ± 1.06	–
Skeletal muscle mass – SMM (kg) by the Lee et al. equation	–	–
Men	28.67 ± 3.23 (n = 19)	32.67 ± 3.53
Women	18.46 ± 4.01 (n = 22)	18.85 ± 3.75
Skeletal muscle mass index – SMI (kg/m^2)	–	–
Men	9.30 ± 077 (n = 19)	10.55 ± 1.52
Women	7.11 ± 1.54 (n = 22)	7.28 ± 1.08

patients than BMI, thus providing a better justification for nutritional care plans. Although calculating patients' FFMI for the diagnosis of malnutrition is not part of the daily routine care, hopefully the need to provide accessible techniques to analyse body composition in various health care settings will be advocated.

The prevalence of sarcopenia was ascertained, based on the skeletal muscle index (SMI). EWSGOP cut-off points were used in order to analyse and compare the SMI values. It is outstanding that even patients with normal or high BMI show reduced muscle mass according to bioelectrical impedance analysis (BIA). Among the inpatients 55% (15 males and 9 females) suffer from moderate, whereas 14% suffer from severe sarcopenia. Understandably, this percentage is lower in case of the outpatients; however, it is still noteworthy that almost 30% (6 males and 1 female) is exposed to moderate sarcopenia. These numbers do not correlate with the BMI categories, since according to them 18% of the clinical and 16% of the outpatients can be considered as sarcopenic. In patients with muscle wasting the energy requirement is usually overestimated, resulting in fat deposition which may therefore lead to sarcopenic obesity. This phenomenon means significant muscle loss with relative fat abundance even when BMI is normal or high (7).

The daily energy expenditure at rest and during physical activity is primarily determined by skeletal muscle mass. Hence, in case of muscle disuse atrophy the energy requirement is decreased. If it is not taken into consideration, the rate of fat deposition will increase enhancing systematic inflammation and insulin resistance, thus the vicious circle of progressive muscle loss and fat gain, which is frequently observed in patients with cancer (7).

Patients' energy and nutrient intake is demonstrated in table 2. Regarding inpatients the average daily intake, including the oral nutritional support, is around 1800 kcal. Due to the metabolical changes the aim is not to overfeed the patients, as it accelerates muscle loss and activates systematic inflammation in bedridden subjects. However, the 1-1.1 g protein/kg body weight intake should be increased to 1.2-1.5 g/kg body weight/day to counteract the anabolic resistance. For muscle-depleted patients with increased fat mass both endurance and resistance-type exercises would be recommended to maintain skeletal muscle mass and functions (7).

In terms of the outpatients, the average 2770 kcal energy intake per day exceeds the recommendations. Not to mention the fact that the extreme consumption of fat is at the expense of carbohydrates and protein. Dietetic intervention should focus on meal planning and the education of cancer patients.

Focusing on oral nutrition support, it has been revealed that 22% of the clinical patients (10 subjects) received 2-3 bottles/day of drinking formulas. Two of

Table 2. Energy and nutrient intake based on 24-hour recalls and 3-day food diaries.

Data	Inpatients (n = 41)	Outpatients (n = 24)
Total energy intake (kcal/day)	1832	2773
Energy (kcal/body weight kg/day)	26	39.6
Carbohydrates (E%)	53.35	45.52
Sugar (E%)	15	8.75
Protein (E%)	17.47	15.24
Animal protein grams/day	52.37	57.63
Plant protein grams/day	27.19	45.46
Fat (E%)	28.6	37.29
Animal fat grams/day	39.85	65.15
Plant fat grams/day	18.38	50.88
Saturated fatty acids (SFA) grams/day	19.15	36.32
Monounsaturated fatty acids (MUFA) grams/day	18.75	36.5
Polyunsaturated fatty acids (PUFA) grams/day	9.5	26.6
Fibre grams/day	18	37
Fluid intake litre/day	1.5	2.15

them were moderately, whereas 8 were severely at risk of malnutrition. However, another 18 subjects who were also severe risk patients received no ONS at all. Consequently, it can be concluded that ONS is not provided based on malnutrition risk groups.

DISCUSSION

This study investigated the usefulness of complex nutritional status assessment, body composition analysis and malnutrition risk screening in case of cancer patients. First of all, it has been clearly seen that relying only on the BMI categories is not advisable since the high BMI values may not reveal the presence of sarcopenia or sarcopenic obesity. Secondly, the validated NRS 2002 risk screening method could be used to detect the risk of malnutrition, however, if it is complemented by body composition analysis applying the previously described BIA device, the results could be even more accurate. Consequently, nutrition care plans designed for each cancer patient individually could be set up and the optimal necessary nutrition process could be launched without delays.

Regarding patients' energy and nutrient intake the nutrition teams have to face various challenges. Not only the daily energy intake but the composition of patients' diet should also be revised and altered so that the subjects receive all the vital macro and micronutrients they need with special focus on proteins. In terms of fats, apart from the quantity, quality should also be adjusted. May ONS be not sufficient in case of the inpatients, enteral and parenteral nutrition should be taken into consideration since this group is exposed to severe malnutrition and muscle wasting owing to their cachectic status.

CONCLUSIONS

In summary, the results of this cross-sectional study demonstrate that the spectrum of cancer patients' body composition is wide, ranging from the minimal or no weight loss and the high BMI of sarcopenic obesity to the extreme loss of fat and muscle. On the one hand, all the above mentioned altered conditions of body composition are associated with increased morbidity and mortality. On the other hand, sarcopenia and malnutrition impose a remarkable burden on healthcare services both financially and in terms of medical care as well.

Apart from malnutrition risk screening, which should be conducted in case of every hospital admission, it would also be worthwhile to examine the body composition and to assess the muscle mass and strength with the help of all currently available tools in the clinical practice. Early identification of sarcopenia and malnutrition would allow dietitians, working as members of the nutrition teams, to implement timely appropriate preventative and therapeutic interventions, for instance, by providing ONS. Following the British and American nutritional care plan models, continuous monitoring is of key importance, since patients' needs are constantly changing throughout the different disease states.

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