Regular paper

Prevalence of poor nutrition status in multiple sclerosis patients assessed by different diagnostic tools

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Patients with multiple sclerosis (MS) present a spectrum of nutritional disorders from obesity to malnutrition. The purpose of this study was an assessment of the nutritional status of MS patients by NRS-2002 and GLIM criteria. Methods: 147 patients were included in the study. The nutritional status was assessed by NRS 2002, GLIM, and body composition analysis. The routine biochemical parameters were measured. Results: Deterioration of the nutritional status was observed in 87.8% of patients. GLIM criteria indicated that 20% of patients were malnourished and 80% were at risk. The percentage of patients with excess body mass was 46.8%, and of underweight patients was 6.6%. The risk of malnutrition was positively associated with low content of adipose tissue (R=−0.24; p=0.00), low BMI (R=−0.22; p=0.00), and higher weight loss in the last 6 months (R=0.47; p=0.00). Additionally, a significant (p<0.05) correlation between malnutrition state and s-albumin (R=−0.2) and CRP (R=0.23) was observed. Conclusion: Overweight and obesity concerned a large proportion of the studied group of MS patients, but this does not exclude the risk of malnutrition. Dietary care and regular outpatient nutritional status assessment should be provided throughout the disease.

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Abbreviations: BMI, Body Mass Index; CRP, C reactive protein; ESPEN, European Society for Clinical Nutrition and Metabolism; GLIM, Global Leadership Initiative on Malnutrition; MS, Multiple Sclerosis; NRS-2002, Nutritional Risk Screening 2002; UBWL, Unintentional body weight loss

INTRODUCTION

Multiple sclerosis is a chronic neurological disease that leads to disability (Oh *et al.*, 2018). At the beginning of the disease, patients often present excess body weight, while in advanced stages, signs of malnutrition appear, and the need to introduce enteral nutrition. It seems that the spectrum of disorders from obesity to malnutrition may be of clinical significance. The symptomatology of MS is very diverse, patients suffer from movement disorders (limb paresis, ataxia), sensory disorders (persistent paraesthesia, hypoaesthesia, hyperesthesia), cranial nerves lesion (oculomotor paralysis, visual disturbances, trigeminal neuralgia), as well as vegetative and mental disorders (cognitive and mood disorders) (Łabuz-Roszak *et al.,* 2013). Depression, mood disorders, mobility limita-

tions, and dysphagia directly affect the nutritional status of people suffering from multiple sclerosis.

At the beginning of the disease, mood disorders, lack of proper diet, and the desire to comfort with food result in the consumption of processed foods rich in sugar and saturated fats – which is associated with body composition disturbances, including an increased amount of adipose tissue (Pilutti *et al.,* 2016; Mokry *et al.,* 2016). Additionally, steroid therapy and a sedentary lifestyle due to progressive disability increase the risk of obesity and its characteristic complications. In the later stages, gastrointestinal problems, such as gastroesophageal reflux, delayed gastric emptying, constipation, and dysphagia can be diagnosed. Dysphagia is the cause of dehydration and malnutrition (D'Amico *et al.,* 2018; Ansari *et al.,* 2020).

The dietitian should adjust the composition of the diet and the amount, volume, and consistency of meals and recommend thickeners depending on the patient's current situation. Next, oral nutritional supplementation or enteral or parenteral nutrition may be necessary (Afifi *et al.,* 2021; Burgos *et al.,* 2008). There is a need for the early identification of patients at risk of malnutrition because the therapeutic possibilities are much greater in this stage than in advanced cachexia.

Therefore, our study was aimed at exploring the nutritional status by NRS 2002 and GLIM criteria of patients treated for multiple sclerosis in a stable clinical condition.

MATERIALS AND METHODS

The population of the study consisted of 147 MS patients (M=38), with an average age of 40.4±11.6 years, consecutively admitted to the neurology ward of a Specialist Hospital during a six-month period. All subjects gave their informed consent for inclusion before they participated in the study. The study received the approval of the Ethics Committee of the Medical University of Gdansk. The 57.8% of patients presented the following comorbidities: 18% hypothyroidism, 16% hypertension, 16% hyperlipidemia, 12% depression, 6% Hashimoto's disease, 5% diabetes, 5% allergy or asthma, 3% hyperthyroidism, 3% epilepsy, 2% anemia, and 1% psoriasis. The mean time since MS diagnosis was 6.5±4.9; there is no dysphagia recognized in the study group.

Nutritional status and body composition were evaluated at admission by the NRS 2002 (the Nutritional Risk Screening) and the GLIM (the Global Leadership Initiative on Malnutrition) criteria which were applied by a trained clinical examiner. In addition, each patient underwent an analysis of his/her medical records to obtain information regarding concomitant diseases and anthro-

pometric parameters, such as body mass by electronic weight and body mass index calculation (BMI), and bio-impedance analysis with the use of the InBody 120 analyzer.

The following biochemical parameters were measured by routine laboratory methods: C-reactive protein (CRP), s-albumin level, lipid profile, and whole blood morphology.

Statistical analysis

Results are expressed as mean and standard deviation or percentages (for categorical variables). The Shapiro-Wilk W test was used to evaluate the normal distribution of the tested parameters. On the other hand, the Leven (Brown-Forsythe) test was used to test the hypothesis of equal variances. Pearson and/or Spearman correlation coefficients were used to calculate the correlation between the variables. A p-value <0.05 was considered to be statistically significant. Statistical processing of the results was performed with the use of the statistical software STATISTICA PL v 13.0 (Statsoft, Krakow, Poland).

RESULTS

In the study group, the mean body weight was 72.6 ± 16.9 (range 45.0–130.0 kg) and the mean BMI was 25.1 kg/m² (range 16.1–43.4). 6.6% of patients presented as underweight with a body mass index <18.5 kg m² (14.4% with BMI <20), and normal body weight was observed in 74 subjects (50.3%). High BMI (BMI >25) was presented in 42.1% of pts. The mean content of % body fat was 30.7 (range 9.9–52.0) – for females – 33.1% and for men 23.7%.

Independently of the BMI, according to the GLIM criteria, the majority of patients (85.5%) were at risk of malnutrition and 15.5% exhibited malnutrition. Based on the NRS 2002, a slight deterioration of the nutritional status was observed in 87.8% of patients, moderate in 9.5% and severe in 2.7%. Analysis showed a strong correlation between both methods (R=0.8; $p<0.05$).

Unintentional body weight loss (UBWL) in the last 6 months was observed in 28% of patients in mean level 1.4 kg (range 0–20 kg). 58% of patients did not change their body weight within the last 6 months. 9% of patients reduced their body weight intentionally by using various diets, including those generally available on the Internet, individual diets from dietitians, or by restricting selected groups of food products. There was also a group of patients who gained weight (5%).

The malnourished patients in comparison to patients "at risk" were older (57.4 ± 12.8 vs 43.3 ± 13.3, $p<0.05$) and presented significantly lower body fat (25.8 ± 7.0 vs 31.3 ± 8.8, $p<0.05$), FFMI (14.8 ± 1.1 vs 17.9 ± 2.6, $p<0.00$), s-albumin (26.0 ± 4.1 vs 39.4 ± 4.0, $p<0.05$) and higher CRP serum level (12.1 ± 3.2 vs 4.4 ±13.4, $p<0.05$) (see Table 1).

The risk of malnutrition was positively associated with low content of adipose tissue (R=–0.24; p=0.00), low BMI (R=–0.22; p=0.00), and higher weight loss in the last 6 months (R=0.47; p=0.00). However, a statistically significant correlation was observed between the malnutrition diagnosis and s-albumin (R=–0.2; $p<0.05$) and CRP (R=0.23; $p<0.05$).

DISCUSSION

The aim of the study was to estimate the prevalence of risk for malnutrition and malnutrition among MS patients treated on neurology wards assessed with the NRS 2002, routine screening method in hospital patients (Burgos *et al.*, 2008). It was evaluated in comparison to the GLIM criteria, the newest and recommended by the ESPEN tool for nutritional status assessment, as well as in comparison to BMI (Håkonsen *et al.*, 2015; Cederholm *et al.*, 2020). To our knowledge, there are no other studies that used GLIM criteria in a group of patients with multiple sclerosis.

Our data show that the risk of malnutrition is a significant problem among MS patients. The prevalence of deterioration of nutritional status reached 85.5%, indicating that a considerable number of patients were in need of appropriate nutritional advice.

It is worth emphasizing that regardless of the BMI, there may be observed unfavorable changes in body composition and nutritional status such as UBWL or decreased albumin level in this group of patients. A high BMI should not delay nutritional interventions because, in the early stages, the interventions are much more effective (Atuk Kahraman *et al.*, 2021; Synnot *et al.*, 2016).

In our study, malnutrition was associated with elevated CRP. Some authors (Palavra *et al.*, 2016; Taheri *et al.*, 2017) reported an increase in inflammatory markers in MS patients. For example, interleukin (IL-6) plays a significant role in the development of malnutrition through the catabolism of muscle proteins and the anorectic effect of cytokines (increased leptin production and lipolysis). An increased level of cytokines is characteristic of hypoalbuminemic patients and is associated with shorter survival

Table 1. Selected parameters in study MS groups. Data are presented as mean ± S.D. or %.

Parameters	All MS patients n =147	MS patients at risk n=123	MS patients malnourished n=23	References values
Age (yr)	40.4±11.6	43.3±13.3	57.4 12.8*/**	–
BMI	25.1±5.5	25.4±5.6	22.4 ±3.3	18.5–24.99
Comorbidities (%)	57.8%	51.7%	54.6%	–
FFMI	17.2±2.7	17.9±2.6	14.8±1.1*	>16
Body fat (%)	30.7±8.8	31.3±8.8*	25.8±7.0*	26.4±6.7
Albumin (g/l)	43.7±5.0	39.4±4.0*	26.0±4.1*	43.5±2.4
CRP (mg/l)	2.7±4.5	4.4±13.4	12.1±3.2*	1.8±1.5

*malnourished *vs* at risk; $p<0.05$; FFMI, fat free mass index; CRP, C-reactive protein

in a different group of chronically ill patients (Yalachkov *et al.*, 2021).

Many authors and ESPEN guidelines postulated that the analysis of body composition should be an essential part of the assessment of nutritional status (Burgos *et al.*, 2018; Hedström *et al.*, 2012). In patients with multiple sclerosis, an analysis of body composition may indicate loss / low muscle mass regardless of excess body weight, suggesting an initial stage of malnutrition. Risk factors for sarcopenia or sarcopenic obesity are metabolic disorders due to chronic diseases, treatment with glucocorticosteroids, and reduced physical activity (Kvistad *et al.*, 2015). The research shows that people diagnosed with multiple sclerosis lead a sedentary lifestyle and usually do not engage in physical activity (Cavanaugh *et al.*, 2011; Goldman *et al.*, 2008). Other authors point to poor dietary habits (Bromley *et al.*, 2019).

Additionally, many patients with MS already seek complementary and alternative treatments or diets for their condition. Unfortunately, the Internet remains the central source of information for most patients, frequently leading to choices and behaviors lacking any scientific support. A scientific analysis of different dietary patterns or other gut-oriented interventions is necessary (Synnot *et al.*, 2016; Bromley *et al.*, 2019).

Therefore, in patients with MS diagnosis, the weight loss process in the case of obesity should be controlled by an experienced dietitian in order to maintain muscle mass.

The limitation of our study is the relatively low number of patients. Further studies in patients with MS (e.g., multicenter) are needed to confirm our results.

CONCLUSIONS AND CLINICAL IMPLICATION

Overweight and obesity concerned a large proportion of the studied group of patients with multiple sclerosis, not excluding the risk of malnutrition confirmed by methods such as NRS 2002 and GLIM. This risk may increase or may develop malnutrition as the disease progresses. Therefore, regular nutritional assessment and dietary consultation should be part of the care. In addition to screening methods, an assessment of nutritional status should include body composition and diet estimation to prevent nutritional problems.

Declarations

The authors have no potential conflicts of interest to disclosure.

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