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What increases the risk of malnutrition in Parkinson's disease?

Svetlana Tomic [a,b,*], Vlasta Pekic [a,b], Zeljka Popijac [a], Tomislav Pucic [a], Marta Petek [a,b], Tihana Gilman Kuric [a,b], Sanja Misevic [a], Ruzica Palic Kramaric [a,b]

[a] Clinical Department of Neurology, Osijek University Hospital Center, Osijek, Croatia
[b] School of Medicine, Josip Juraj Strossmayer University in Osijek, Osijek, Croatia

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ABSTRACT

Parkinson's disease (PD) patients are at a higher risk of malnutrition. The prevalence has been estimated to 0–24%, while 3%–60% of PD patients are reported to be at risk of malnutrition. To date, there is no clear explanation for malnutrition in these patients. The aim of this study was to determine the prevalence of malnutrition and to analyze factors that influence its appearance. The Mini Nutritional Assessment (MNA) was used to determine normal nutritional status; at risk of malnutrition; and already malnourished status. The Unified Parkinson's Disease Rating Scale (UPDRS) parts III and IV, Hoehn and Yahr scale (H&Y scale), Beck Depression Inventory (BDI), Mini Mental State Examination (MMSE), Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease-Rating Scale - eating part (QUIP-RS) and Mini Nutritional Assessment (MNA) were used to evaluate the factors affecting patient nutritional status. Out of 96 patients, 55,2% were at risk of malnutrition, while 8,3% had already been malnourished. Age, H&Y scale, UPDRS part III, 'off' periods and depression influence negatively on MNA. More patients with 'off' periods were rigor dominant. Thyroid gland hormone therapy was related to malnutrition, while patients with normal nutritional status used ropinirole more often than pramipexole. Factors affecting nutritional status are age, motor symptoms and stage severity, 'off' states, rigidity dominant type with 'off' states, and thyroid hormone replacement therapy. Ropinirole exhibited the possible 'protective' effect against malnutrition.

1. Introduction

Parkinson's disease (PD) is neurodegenerative disease with diffuse synuclein pathology deposits. This leads to a decrease in the dopaminergic, serotonergic, noradrenergic and cholinergic neurotransmitter system [1]. As a consequence, many different symptoms appear, generally divided into motor and non-motor ones. One of the non-motor symptoms is weight loss and a high risk of malnutrition that often remains under-recognized and under-diagnosed [2]. The prevalence of malnutrition has been estimated to 0–24%, while 3%–60% of PD patients are reported to be at risk of malnutrition [3]. A decrease of body weight has been reported even in the prediagnostic PD stage [4]. To date, there is no clear explanation for malnutrition in these patients and the mechanisms such as perturbation of hypothalamic metabolic regulation, alteration of energy expenditure and alteration of nutrient intake have been proposed [4,5]. These patients frequently display loss of muscles, body fat and lean body mass [3,6,7]. Many factors have been reported to be associated with malnourishment in these patients, e.g., non-motor and motor symptoms, older age at diagnosis, higher levodopa equivalent daily dose (LEDD)/body weight, depression, dementia and hallucinations [2,8,9]. Impairment of gastrointestinal function (dysphagia, delayed gastric emptying, constipation, malabsorption) and disturbed hand-mouth coordination can also impact nutritional status [10–12]. A low-protein diet used to increase bioavailability of levodopa (patients with severe postprandial "off" periods are often advised to take a "protein-redistribution diet") may further worsen nutritional status of the patients [13]. Therapy with dopamine agonists may additionally influence body mass through many adverse events. Losing body mass can occur due to nausea, vomiting or anorexia. On the other hand, dopamine agonists may also cause weight gain through the mechanism of impulse control disorders [14,15]. Mini Nutritional Assessment (MNA) test is a simple, noninvasive, well-validated screening tool for malnutrition in elderly persons. It is recommended for early detection of the risk of malnutrition and lifestyle characteristics associated with nutritional risk while albumin levels and BMI still are within the normal range. Appropriate nutritional interventions can be introduced on the basis of MNA results. Besides screening, it can also be useful in follow up of the nutritional intervention efficacy [16]. Malnourished PD patients have a poorer quality of life due to the risk of infection, decubital ulcer, and acceleration of motor, behavioral and autonomic impairment [17,18]. Improvement in nutritional status increases the quality of life

* Corresponding author at: Clinical Department of Neurology, Osijek University Hospital Center, School of Medicine, Josip Juraj Strossmayer University in Osijek, J. Huttlera 4, HR-31000 Osijek, Croatia.
E-mail address: svetlana.tomic@vip.hr (S. Tomic).

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[17]. The aim of this study was to determine the prevalence of malnutrition and to analyze factors that influence the occurrence of malnutrition in PD patients.

2. Patients and methods

This cross-sectional study included patients diagnosed with idiopathic PD according to the UKPD Society Brain Bank (UKPDSBB) diagnostic criteria [19]. Patients were recruited from May 2014 till May 2015. All participants signed their written informed consent, while the study protocol was reviewed and approved by the Osijek University Hospital Center Ethics Board and was consistent with the Declaration of Helsinki. General data on age, sex, disease duration and therapy (dopamine agonists and thyroid gland hormones) were collected by use of a specially designed questionnaire. Patient body weight and height were measured and body mass index (BMI) was calculated. To evaluate motor and non-motor symptoms, motor fluctuations, complications of therapy and impulse control disorders, the Unified Parkinson's Disease Rating Scale (UPDRS) parts III and IV, Hoehn and Yahr scale (H&Y scale), Beck Depression Inventory (BDI), Mini Mental State Examination (MMSE) and Questionnaire for Impulsive-Compulsive Disorders in Parkinson's Disease Rating Scale – eating part (QUIP-RS) were used. According to UPDRS part III, patients were divided into tremor and rigor dominant types of the disease, according to disease duration into two groups (≤5 and >5 years), and according to age into three groups (40–60, 60–80 and >80 years). BMI is person's weight in kilograms divided by the square of height in meters. It is an easy-to-perform method of screening for weight category: underweight (BMI >18.5), normal or healthy weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9), and obesity (BMI >30.0) [20]. The Mini Nutritional Assessment (MNA) was used to determine normal nutritional status; at risk of malnutrition; and already malnourished status. MNA is a short valid nutritional screen for elderly population, recommended by the European Society for Clinical Nutrition and Metabolism (ESPEN) [21]. There is also a short form MNA (MNA-SF) that consists of 6 questions screening for malnutrition. This SF part asks about dietary regime in the last 3 months, weight loss, immobility, recent stress period, neuropsychological disorders (depression and dementia) and BMI. Final score predicts malnutrition risk. If MNA-SF excludes malnutrition, there is no need for completing whole MNA. If the patient is found to be at risk of malnutrition, the examiner passes to the next part, i.e. assessment. In this part, the patient answers questions about food intake habit (place of living, drug regime, skin sores or wounds, food intake habit, mode of feeding, self assessment of nutritional and health status, and measurement of the mid arm and calf circumference in cm). Final score predicts malnutrition (MNA score 24–30, normal nutritional status; MNA score 17–23.5, at risk of malnutrition; and MNA score < 17, already malnourished) [22].

Categorical data were presented as absolute frequencies and percentages, while differences between groups were tested by Fisher exact test. Numerical data were presented with median and interquartile range or with mean and standard deviation, while differences between groups were tested with Kruskal-Wallis test. Correlation between variables that did not show normal distribution was tested with Pearson's coefficient of correlation. Statistical significance was defined as $\alpha = 0.05$, while statistical analysis was conducted with STATISTICA 13 (StatSoft Inc., Tulsa, Oklahama, USA).

3. Results

In this study, 107 patients were included, but only 96 patients (57 male and 39 female) were analyzed because not all patients were able to complete all questionnaires. Table 1 shows demographic data and results of the UPDRS III, H&Y scale, BMI and MNA. Normal nutritional status was recorded in 36.5% of study patients, while 55.2% were at risk of malnutrition and 8.3% had already been malnourished. Dyskinesias were present in 16.7%, while "off" periods were reported by nearly half of study patients (44.8%). There was a slight predominance of the tremor dominant type of PD (52.1% vs. 47.9%). Table 2 shows between-group differences according to sex, age, disease duration, motor and non-motor symptoms, motor fluctuations, therapy complications and MNA. Malnourished patients had a higher disease stage and higher UPDRS part III score (Table 2). MMSE score was similar across all three groups, whereas BDI score was higher in malnourished patients (Table 2). Significant differences between groups divided according to nutritional status were recorded for age ($p = 0.041$), H&Y scale ($p = 0.017$), "off" periods ($p = 0.027$) and depression ($p = 0.004$). Motor symptoms measured with UPDRS part III ($rs = -0.367$; $p < 0.001$) and H&Y scale ($rs = -0.330$; $p = 0.001$), as well as depression ($rs = -0.313$; $p = 0.002$) correlated negatively with MNA (Table 3). There was no difference in MNA between the rigor and tremor dominant types of PD, but we found that 34% of patients were tremor dominant and 56% rigor dominant in the "off" group, whereas in the group without "off" periods the respective figures were 66.5% and 43.5% of patients, yielding a statistically significant difference ($p = 0.027$). Most of the patients did not report impulse control disorders in eating section, and there was no significant between-group difference (Table 4). Therapy analysis yielded significant results only for thyroid hormone and malnutrition ($p = 0.018$). Patients with normal nutritional status more often used ropinirole than pramipexole (15 vs. 6) (Table 4), yielding a statistically significant difference ($p = 0.019$).

Table 1
Data about age, disease duration, UPDRS III, H&Y scale, weight, high, BMI and MNA.

	Minimum	Maximum	Mean	Std. deviation
Age	41	86	70,22	8,598
Disease duration	1	20	5,79	4,542
UPDRS part III	1	83	19,34	13,529
H&Y scale	0	4	2	0,5
Weight	48	128	81,06	18,369
High	145	188	165,66	9,483
BMI	19,1	45,58	29,4569	5,91,046
MNA	10,0	29,5	22,135	3,9832

UPDRS III - Unified Parkinson Disease Rating Scale part III - motor assessment; H&Y scale - Hoehn&Yahr scale; BMI - body mass index; MNA - Mini Nutritional Assessment.

4. Discussion

In this study, the prevalence and factors influencing malnutrition were evaluated in 96 patients with idiopathic PD. Although the mean BMI was high (29.5), indicating that most of our patients were overweight, we found that 8.3% of the patients had already been malnourished, while 55.2% were at risk of malnutrition. Explanation for this lies in the fact that BMI correlated more with direct measures of body fat, while MNA also calculated protein level according to the protein-calorie intake recommendation [16,23]. Patients who are at risk of malnutrition have not yet started to lose weight but have lower protein-calorie intakes than recommended [16]. This confirms that BMI is not good enough to evaluate nutritional status, while MNA is a much more complex tool for evaluation of malnutrition [4]. Sheard et al. reviewed literature on the prevalence of malnutrition in PD patients and found similar data [3]. Moreira et al. investigated risk factors for malnutrition in elderly population (≥65 years) and identified age and PD as the risk factors [24]. Weight loss can precede motor PD stage and disease duration has additional negative influence on malnutrition, while gender has not been reported as a risk factor [4,8,25,26]. We found the same results for age and gender, but MNA results showed no between-group difference in disease duration. Bachmann et al. [27] found higher LEDD with dyskinesia to decrease BMI with development of malnutrition, while Sheard et al. [8] found that greater UPDRS III score with higher H&Y stage correlated with lower MNA results. We also found that malnourished patients had more pronounced motor symptoms and more severe disease stage, but motor fluctuations with "off" periods seemed to