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Applied nutritional investigation

Vitamin B12 and folic acid levels are not related to length of stay in elderly inpatients

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ABSTRACT

Objective: We designed this study, to evaluate the interaction (relation) between vitamin B12 and folic acid levels and length of hospital stay in elderly inpatients.
Methods: In this cross-sectional study, the Mini Nutritional Assessment–Short Form (MNA-SF) test was used to evaluate nutritional status of 615 (239 men, 376 female; mean age 72.89 ± 8.93 y) inpatients of a university hospital. Length of stay and blood samples in elderly inpatients were evaluated.
Results: Only 33.8% of the patients were classified as having an adequate nutritional status; 44.3% had a risk of malnutrition, and 21.8% were classified as malnourished. Low MNA-SF score was related to length of stay, but vitamin B12 and folic acid were not related to risk of malnutrition and length of stay.
Conclusion: MNA-SF score is associated with length of stay; however, vitamin B12 level, per se, is not associated with length of hospital stay in elderly inpatients.

Introduction

Prolonged hospitalization is an important indicator, reflecting total cost of hospital care, and it is established that elderly patients have longer length of hospital stay (LOS) than younger patients [1]. Therefore, it is important to determine the risk factors affecting LOS in elderly patients.

The relationship between nutritional status and LOS in elderly patients was supported by many studies in the literature, and poor nutritional status was found to prolong LOS. Malnutrition is a major risk factor for complications and delayed recovery in elderly inpatients [2–5]. Moreover, it is a common problem in the elderly with a prevalence variance of 10% to 85% [6–8] and is associated with a decline in functional status, impaired muscle function, decreased bone mass, immune dysfunction, anemia, reduced cognitive function, poor wound healing, delayed recovering from surgery, higher hospital and readmission rates, poor quality of life, and mortality [6,9]. Therefore, prevention and treatment of malnutrition is the main goal in clinical nutrition. The early and precise diagnosis of malnutrition is essential to initiate nutritional therapy as soon as possible [10].

Elderly patients are at increased risk of nutrient deficiencies, such as vitamin B12 and folic acid deficiencies [5].Vitamin B12 and folic acid deficiencies may be associated with different pathologies, including cognitive dysfunction and atherosclerotic processes [11,12].

In addition, it was reported that LOS may be related to deficiencies of vitamins B6 and B12, as well as to poorer nutritional status, in 52 elderly rehabilitation patients [5], but interaction between LOS and vitamins B12 and folic acid levels in elderly inpatients has not been detailed in the literature. Hence, we designed this study to evaluate the nutritional status of our elderly inpatients and the interaction between vitamin B12 and folic acid levels and LOS among these patients.

Material and methods

In 2011 (from February through December), 2108 patients who were 60 y of age or older were evaluated in a Bezmialem Vakif University hospital. Among these, 615 (239 men, 376 women) met the inclusion criteria and were enrolled in this study. Before participation, written informed consent was obtained from each participant or legally authorized representative (or both) according to the local guidelines. The investigation conformed to the Declaration of Helsinki and was approved by the ethics committee of the Faculty of Medicine, Bezmialem Vakif University in Istanbul, Turkey (2011/59).

Patients were excluded from this study if they had conditions affecting the absorption of vitamins B12 and folic acid, active neoplasm, untreated

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hypothyroidism, nephrotic syndromes, cirrhosis, malabsorption syndromes, severe heart failure, inflammatory bowel disease, eating and swallowing disorders, or parenteral nutrition. Also excluded were patients taking vitamin B supplements or injections and those who had undergone surgery or needed intensive care treatment. None of these patients had vegetarian or carnivorous diet.

All of the patients underwent a comprehensive geriatric assessment by the same investigator, including a nutritional evaluation via the revised Mini Nutritional Assessment Short-Form (MNA-SF). Patients were divided into three groups according to their MNA-SF scores: malnourished (0–7 points), at risk of malnutrition ("at-risk", 8–11 points), or well-nourished (12–14 points) [13].

The diagnoses of hypertension, hyperlipidemia, diabetes mellitus, obesity, coronary artery disease, heart failure, cerebrovascular disease, dementia, and chronic obstructive pulmonary disease were based on the diagnoses referred to by the patient or caregiver, a review of the clinical history and medical records, and the use of specific medications. Hospital stay time for each patient was recorded after discharge.

To calculate body mass index (BMI), height was measured to the nearest centimeter (cm) and weight was measured to the nearest half-kilogram (kg) with the same stediometer (Nan Baskul: IB 150 BB20, Istanbul, Turkey). BMI was calculated as body weight in kilograms divided by the squared value of body height in meters (kg/m^2). The BMI was classified according to the World Health Organization criteria [14].

To evaluate the biochemical evidence of insufficient intake and the metabolic condition, blood samples were collected in the morning after at least 8 h of fasting for CRP, free triiodothyronine (T3), free thyroxin (T4), thyroid-stimulating hormone (TSH), creatinine and total cholesterol levels, serum albumin, vitamin B12, and folic acid. All of these biochemical tests were carried out on Diagnostic Modular Systems autoanalyzer (Roche E170 and P-800).

Vitamin B12 deficiency was defined as serum vitamin B12 <148 pmol/L (5). Continuous variables were expressed as mean ± standard deviation. Continuous variables were evaluated with Kolmogrov-Smirnov for normal distribution. Continuous variables with normal distribution were evaluated with Independent Sample *t* test or one-way ANOVA. Continuous variables with abnormal distribution were evaluated with Kruskal-Wallis test and Mann-Whitney U test as post hoc. Differences in proportions were evaluated with Pearson χ^2 test. Associations between continuous variables were analyzed with Pearson correlation. Probabilities <0.05 were considered significant. All statistical measurements were made by using SPSS PC v19.0 (SPSS Inc.).

Results

Among the 615 elderly patients (mean age 72.89 ± 8.93 y) only 33.7% were classified as having an adequate nutritional status, 43.7% were classified as at-risk for malnutrition, and 22.6% as malnourished. Prevalence of elevated risk of malnutrition and malnourishment were higher in women, but the differences were not significant (41% and 18.8% in men vs. 45.5% and 25% in women, respectively; $P > 0.05$ for both comparisons). Prevalence of being well-nourished was higher in men (40.2% in men vs. 29.5% in women, $\chi^2 = 7.417$, $P < 0.01$). Mean age was the highest for malnourished patients (74.3 ± 8.1 y) and the lowest for well-nourished patients (71.5 ± 7.7 y) (< 0.005, for each comparison). A Pearson correlation analysis revealed this by showing any correlation between MNA-SF scores and age (r = −0.22) (Fig. 1).

Vitamin B12, Folic acid, TSH and glucose levels were not statistically different between groups. CRP, Albumin, Cholesterol, Free T3, and Creatinine levels in malnourished patients were statistically different than the patients with risk of malnutrition ($p<0.05$ for Creatinine, $p < 0.002$ for others). CRP, Albumin, Cholesterol, Free T3, Free T4 Creatinine levels in malnourished patients were also statistically different than well-nourished patients ($p < 0.05$ for Free T4, $p < 0.001$ for others). Table 1 contains data regarding the variables that correspond to the MNA-SF score.

A Pearson correlation showed that vitamin B12 and folic acid were not correlated with MNA-SF scores (r = 0.009, r = 0.162, respectively) and LOS (r = 0.000, r = −0.065, respectively). A one-way ANOVA showed that the LOS was not different between people with vitamin B12 lower than 148 pmol/L (4.17 ± 4.83 days) and people with vitamin B12 more than 148 pmol/L (4.47 ± 5.42 days), (F = 0.1, P > 0.05).

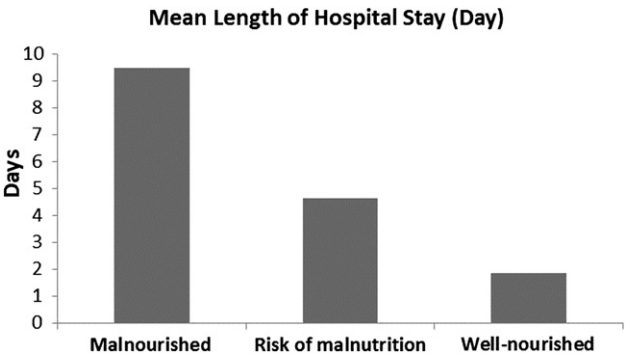

Fig. 1. Mean length of hospital stay (d). Mean length of hospital stay was 1.8 ± 3.3 d in the well-nourished patients, and it was 4.6 ± 4.5 d and 9.5 ± 7.5 d in the patients at risk of malnutrition and the malnourished groups, respectively.

Mean LOS was the highest for malnourished and the lowest for well-nourished patients, and Mann-Whitney U test showed that all groups significantly differed from each other ($P < 0.001$, for each comparison). Also, there was a negative correlation between MNA-SF scores and LOS (r = −0.53) (Fig. 1).

Discussion

In this study, we prospectively evaluated 615 elderly patients who were consecutively admitted to the hospital. It was found that one-fifth of them were malnourished. It was shown that vitamin B12 and folic acid levels different from the poorest nutritional status were not related to LOS in our elderly patients.

Table 1
Descriptives according to MNA-SF Score

	Malnourished ≤7	Risk of malnutrition 8–11	Well-nourished >11
Age	74.3 ± 8.1	72.4 ± 9.4	71.5 ± 7.7
Sex (female/male)	94/45	171/98	111/96
Number of chronic disease	2.39 ± 1.0	2.31 ± 1.1	1.85 ± 1.2
BMI	25.24 ± 5.24	28.44 ± 5.47	28.81 ± 4.78
Chronic disease %			
Obesity	12.0	34.2	38.6
CAD	25.8	29.3	21.2
HF	27.3	14.4	7.7
COPD	9.3	10.0	9.1
CRF	25.8	12.6	3.8
CVD	13.6	6.6	1.4
Dementia	20.8	20.1	25.1
Depression	23.0	26.3	17.3
Gastrointestinal disease	26.6	12.2	10.1
Diabetes	38.1	46	33.8
Hyperlipidemia	9.3	15.6	13.5
Hypertension	71.9	74.7	64.2
Length of hospital stay (d)	9.5 ± 7.5	4.6 ± 4.5	1.8 ± 3.3
Exitus	3	3	2
CRP (mg/L)	5.8 ± 6.9	2.9 ± 4.6	2.4 ± 4.5
Albumin (g/dL)	3.4 ± 0.6	3.5 ± 0.5	3.8 ± 0.5
Glucose (mg/dL)	139.0 ± 73.2	145.7 ± 80.2	132.9 ± 70.9
Cholesterol (mg/dL)	163.7 ± 53.3	184.8 ± 50.1	186.8 ± 48.8
TSH (uIU/mL)	2.2 ± 3.7	1.9 ± 2.1	3.6 ± 15.6
Free T3 (nmol/L)	2.9 ± 1.0	3.3 ± 0.9	3.6 ± 0.9
Free T4 (nmol/L)	15.4 ± 4.0	15.3 ± 3.3	14.5 ± 3.6
Creatinin (mg/dL)	1.7 ± 1.6	1.3 ± 1.5	1.1 ± 0.8
Vitamin B12 (pmol/L)	382.6 ± 212.1	348.1 ± 184.2	374.3 ± 235.7
Folic Acid (ng/mL)	7.7 ± 3.7	8.2 ± 4.2	8.4 ± 3.9

CAD, coronary artery disease; HF, heart failure; COPD, chronic obstructive pulmonary disease; CRF, chronic renal failure; CVD, cerebrovascular disease; BMI, body mass index.

Aging is associated with an increased risk of malnutrition. To prevent malnutrition and malnutrition-related complications, early detection of at-risk patients is critical, because this guides early and optimal nutritional support [15]. The revised MNA-SF increases the applicability of this rapid screening tool in clinical practice through the inclusion of a malnourished category and is a valid nutritional screening tool [14]. Therefore, the revised MNA-SF was used in the present study to evaluate the nutritional status of inpatient elderly patients and is a part of comprehensive geriatric assessment in our geriatric practice.

Our results were compatible with those in the literature [16,17], i.e., well-nourished elderly inpatients had better results than at-risk and malnourished ones. Although the rate of malnutrition risk in 122 elderly inpatients in Turkey was reported to be 39% [17], it was 43.7% in our study. Similar to that study, 22% of our inpatients were malnourished [17]; however, malnourishment in those older than 70 y old was reported as 43% [5] compared with 25–31% of the patients in our study. This difference might result from a less restrictive inclusion criteria, as well as from different nutritional assessment and multicenter and regional differences. In a study of 244 elderly inpatients from Sweden [2], in which nutritional status was assessed by anthropometry, weight, history, and biochemical measurement, risk of malnutrition was reported as 51.6%. It was also shown that 44% of the patients older than 60 y were at risk for malnutrition, although in our study, malnutrition rates increased remarkably by decades.

Poor nutritional status contribution to LOS in elderly inpatients has been widely accepted [3–5], although there are some contradicting studies in the literature [18]. In concordance with the literature, interaction between nutritional status and LOS in elderly patients was shown in our study.

In the present study, when the evaluation of some nutrients, such as vitamin B12 and folic acid levels, in elderly inpatients were detailed, in contrast to the current literature [5], malnutrition was not related to vitamin B12 and folic acid levels, but at-risk patients had the lowest vitamin B12 levels of the groups. However, it was previously reported that both vitamin B12 and folic acid, and high dietary intakes of them, were related to risk of mortality from stroke, CHD, and heart failure [19–21]. In addition, LOS in our population did not relate to vitamin B12 and folic acid levels. This was not compatible with the O'Leary et al. study [5] of Australia, which evaluated B vitamin status, dietary intake, and length of stay in 52 elderly rehabilitation patients. They pointed out the high risk of vitamin B deficiencies in the elderly and suggested that deficiencies of B12 are associated with length of stay. This well-designed study, unfortunately, had a small sample size and only subacute rehabilitation patients were included. However, all of the patients in our study were elderly inpatients. Furthermore, in subgroup analysis, the level of vitamin B12 above or below 148 pmol/L did not relate to LOS in our study group.

The limitations of this study were its cross-sectional nature and inability to measure the serum levels of homocysteine and methylmalonic acid. For this reason, we have started a new study to evaluate the nutritional changes of elderly outpatients and inpatients under geriatric follow-up.

Conclusion

Evaluation of nutritional status is one of the most important topics in geriatric medicine, and poor nutritional status in elderly inpatients is related to lengthened hospital stay. However, our results showed that vitamin B12 and folic acid levels are not, in terms of independent nutritional status, related to lengthened hospital stay for elderly inpatients.

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