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Frequency of malnutrition and associated risk factors in geriatric patients in a palliative care unit

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Abstract

Introduction: Our study aimed to determine the frequency of malnutrition and associated risk factors in older patients receiving palliative care.

Material and methods: This prospective cross-sectional study was performed with older patients hospitalized and treated in the palliative care unit of our university between December 1, 2022 and June 1, 2023. The demographic characteristics of the patients, reasons for palliative care admission, and the referring unit were recorded. The patients' nutritional status was assessed using the full mini nutritional assessment (MNA) and the geriatric nutritional risk index (GNRI). Selected laboratory parameters were recorded at admission to the palliative care unit.

Results: The 371 patients included in the study had a median age of 74 years and 58.5% were female. Malnutrition was detected more frequently in geriatric palliative care patients with cerebrovascular disease, malignancy, dementia, and congestive heart failure. Malnutrition was detected in 69.32% of the patients according to GNRI and in 64.80% according to MNA. Prealbumin had the highest specificity (92.3%) at a cut-off value of 0.175 mg/dl. The multivariate logistic regression model created with these variables showed that female sex, Ca, Cl, prealbumin, and hemoglobin were significant independent risk factors for malnutrition ($p < 0.05$). Female sex was associated with 2.5 times higher odds of malnutrition.

Conclusions: The prevalence of malnutrition was found to be high among geriatric palliative care patients in our study. The geriatric nutritional risk index can be used to diagnose malnutrition in immobile older palliative care patients and may be applied in routine patient follow-up to help improve quality of life.

Key words: malnutrition, palliative care, risk factors.

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INTRODUCTION

Technological advances and the development of new treatment methods result in increased life expectancy. As the geriatric population grows, there is also an increase in chronic diseases, associated symptoms, and the need for palliative care for older adults. Palliative care aims to provide symptom relief and improve quality of life through the collaboration of a multidisciplinary team. Adequate and balanced nutrition is one of the parameters that increase the quality of life [1]. Inadequate or unbalanced nutrition leads to malnutrition. The prevalence of malnutrition is high in the older population due to cognitive impairment, comorbid diseases, polypharmacy, depression, and senile anorexia [2]. Malnutrition increases morbidity and mortality [3], disrupts physical, mental, and social function, and leads to increased health expenditures [4, 5]. In addition, the presence of malnutrition is associated with other geriatric syndromes such as frailty and sarcopenia [6]. Its frequency among older inpatients varies between 11 and 45% [7–9].

All patients hospitalized in our country are evaluated using a nutritional screening instrument according to the European Society of Clinical Nutrition and Metabolism guidelines within the first 24 hours of admission [10]. Although many instruments are used in practice, there is controversy over which should be considered the gold standard [11].

The mini nutritional assessment (MNA) has low specificity but a high diagnostic rate for malnutrition [12]. However, disadvantages of the MNA are that the test is long and cannot be applied in people with dementia or communication problems [9]. The geriatric nutritional risk index (GNRI) was developed especially for older adults and is used to diagnose malnutrition and predict malnutrition-related complications [13]. It has also been demonstrated to be reliable in patients with dementia, aphasia, and apraxia [4].

In light of this information, our study aimed to determine the frequency of malnutrition and associated risk factors in older patients receiving palliative care.

MATERIAL AND METHODS

This prospective cross-sectional study was performed with older patients hospitalized and treated in the palliative care unit of our university between December 1, 2022 and June 1, 2023.

Inclusion criteria were being 65 years of age or older, being hospitalized in the palliative care unit for 24 hours or more, and providing written informed consent to participate in the study. Exclusion criteria were age less than 65 years, hospitalization in the palliative care unit for less than 24 hours, repeated admission to the palliative care unit, and not providing informed consent.

The demographic characteristics of the patients (age, gender, chronic diseases, and drugs used), reasons for palliative care admission, and the referring unit were recorded.

The patients' nutritional status was assessed using the full MNA and the GNRI. The full MNA test consists of 18 items:

- anthropometric measurements (4 questions about height, weight, body mass index, upper arm circumference, calf diameter),
- dietary habits (6 questions about number of meals, food intake, fluid intake, whether eating assistance is needed),
- general assessment (6 questions about level of independence, drugs used, mobility, mental status, skin changes, and acute stress in the last 3 months),
- subjective assessment of oral intake (2 questions about self-perceptions about health and nutrition).

The patients' nutritional status was determined according to their score on the full MNA. The total score ranges from 0 to 30, with scores of 24 or higher interpreted as normal nutritional status (well-nourished), scores of 17–23.5 as risk of malnutrition, and scores lower than 17 as malnutrition [14]. The validity and reliability of the Turkish version of the instrument were analyzed by Sar kaya *et al*. in 2015 [15].

The geriatric nutritional risk index was first used in 2005 to evaluate the nutritional status of older immobile patients. This scoring system utilizes the patient's ideal body weight, calculated using the Lorentz formula:

For men: height – 100 (height – 150)/4; for women: height – 100 (height – 150/2.5).

The geriatric nutritional risk index is calculated using this value and the patient's height, weight, and serum albumin values as follows:

GNRI = 1.489 × albumin (g/l) + 41.7 × (actual weight/ideal body weight)

The geriatric nutritional risk index < 82 is interpreted as severe malnutrition, 82–92 as moderate malnutrition, 92–98 as malnutrition, and GNRI > 98 as no risk of malnutrition [13].

Selected laboratory parameters were recorded at admission to the palliative care unit: blood urea nitrogen (BUN), creatinine, sodium (Na), potassium (K), calcium (Ca), phosphorus (P), chlorine (Cl), magnesium (Mg), uric acid, white blood cells, neutrophils, lymphocyte and platelet counts, mean platelet volume, hemoglobin (Hb), hematocrit, sedimentation, procalcitonin, C-reactive protein (CRP), albumin, prealbumin, and glucose.

Statistical analysis

All analyses were performed using IBM SPSS Statistics version 20.0 (IBM; http://www.spss.com). Categorical variables were presented as frequency and percentage, and numerical variables as mean ± standard error or median and range or interquartile range. The chi-square test was used to compare categorical data, and the Mann-Whitney *U* test was used to compare continuous variables. A logistic regression model was created for risk analysis. In all tests, $p < 0.05$ was considered significant.

Approval to conduct the study was obtained from the Ethics Committee of Atatürk University Faculty of Health Sciences (date: 08.11.2022, meeting no: 2022/11/26).

RESULTS

The 371 patients included in the study had a median age of 74 years (range, 65–99 years) and 217 (58.5%) were female. Comparisons of the patients' basic characteristics according to the presence of malnutrition are shown in Table 1. Malnutrition was detected more frequently in geriatric palliative care patients with cerebrovascular disease (CVD), malignancy, dementia, and congestive heart failure (CHF) ($p < 0.05$) (Table 1). In addition, patients with malnutrition were significantly older than those without malnutrition, and malnutrition was more

Table 1. Distribution of basic characteristics in geriatric palliative care patients with and without malnutrition

References	Malnutrition		*p*-value
	No (*n* = 130)	Yes (*n* = 241)	
Age, median (IQR)	73 (69–76)	77 (70–82)	**< 0.001**
Gender, *n* (%)			
Male	65 (50.0)	89 (36.9)	**0.010**
Female	65 (50.0)	152 (63.1)	
Comorbidities, *n* (%)			
HT	94 (72.3)	185 (76.8)	0.205
CAD	46 (35.4)	99 (41.1)	0.168
DM	41 (31.5)	77 (32.0)	0.516
CVD	5 (3.8)	46 (19.1)	**< 0.001**
Malignancy	4 (3.1)	38 (15.8)	**< 0.001**
Dementia	5 (3.8)	45 (18.7)	**< 0.001**
COPD	31 (23.8)	44 (18.3)	0.127
CHF	14 (10.8)	46 (19.1)	**0.025**
CKD	12 (9.2)	34 (14.1)	0.115
Hypothyroidism	16 (12.3)	27 (11.2)	0.437
Hyperthyroidism	3 (2.3)	10 (4.1)	0.273
Parkinson disease	2 (1.5)	12 (5.0)	0.079
PVD	8 (6.2)	8 (3.3)	0.155
Number of diseases, median (IQR)	3 (2–4)	4 (3–5)	0.104
Number of drugs used, median (IQR)	5 (3–6)	6 (4–8)	**0.001**

CAD – coronary artery disease, CHF – congestive heart failure, CKD – chronic kidney disease, COPD – chronic obstructive pulmonary disease, CVD – cerebrovascular disease, DM – diabetes mellitus, HT – hypertension, IQR – interquartile range, PVD – peripheral vascular disease
Statistically significant parameters are indicated in bold.

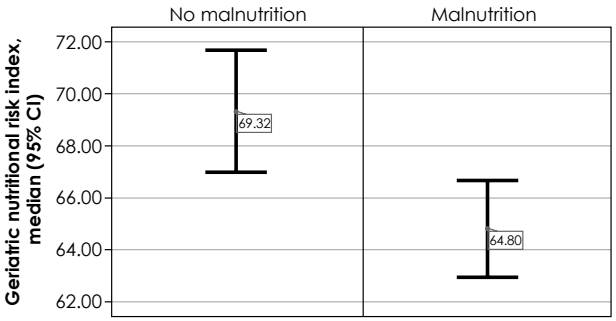

Fig. 1. Geriatric nutritional risk index values of geriatric palliative care patients with and without malnutrition according to the mini nutritional assessment (values in boxes are median, bars represent 95% CI)

common among women ($p < 0.001$ and $p = 0.010$, respectively).

The distribution of GNRI values in geriatric patients with and without malnutrition according to the full MNA is presented in Figure 1. Geriatric nutritional risk index values were significantly lower in those with malnutrition ($p = 0.003$).

Comparisons of laboratory values at admission according to the presence of malnutrition in geriatric palliative care patients is presented in Table 2. Those with malnutrition had significantly lower albumin, prealbumin, Hb, lymphocyte count, uric acid, sodium, calcium, magnesium, chlorine, and potassium values compared to those without malnutrition ($p < 0.05$). In contrast, BUN, leukocyte, and CRP levels were found to be significantly higher in patients with malnutrition ($p < 0.05$) (Table 2).

The diagnostic value, specificity, and sensitivity of laboratory parameters at admission to the determined cut-off values are shown in Table 3. Of the evaluated biomarkers, prealbumin and Hb had the highest diagnostic value. Prealbumin had the highest specificity (92.3%) at a cut-off value of 0.175 mg/dl.

Comorbidities and admitting laboratory parameters associated with malnutrition risk in geriatric palliative care patients were evaluated by univariate and multivariate logistic regression analysis (Table 4). The results of univariate logistic regression analysis indicated that age, female sex, CVD, malignancy, dementia, CHF, number of drugs used, BUN, K, Ca, Cl, albumin, prealbumin, and Hb were factors statistically significantly associated with malnutrition (Table 3) ($p < 0.05$). The multivariate logistic regression model created with these variables showed that female sex, Ca, Cl, prealbumin, and Hb were significant independent risk factors for malnutrition ($p < 0.05$). Female sex was associated with 2.5 times higher odds of mal-

Table 2. Distribution of laboratory values at admission according to the presence of malnutrition in geriatric palliative care patients

Parameters	Malnutrition		*p*-value
	No (*n* = 130)	Yes (*n* = 241)	
BUN [mg/dl]	16.9 (14.4–22.0)	20.0 (14.5–30.5)	**0.001**
Creatinine [mg/dl]	0.85 (0.72–1.01)	0.80 (0.59–1.13)	0.152
Na [mEq/l]	140 (138–142)	139 (136–141)	**< 0.001**
K [mEq/l]	4.4 (4.1–4.6)	4.3 (3.8–4.7)	**0.014**
Ca [mg/dl]	9.4 (9.1–9.7)	8.7 (8.1–9.2)	**< 0.001**
P [mg/dl]	3.2 (2.8–3.6)	3.1 (2.7–3.6)	0.718
Mg [mg/dl]	1.9 (1.8–2.0)	1.8 (1.6–2.0)	**0.007**
Cl [mmol/l]	107 (105–108)	104 (100–107)	**< 0.001**
Uric acid [mg/dl]	5.6 (4.7–6.4)	5.1 (3.9–6.8)	**0.013**
Leukocytes [103/µl]	6980 (5910–8970)	7410 (5810–10.000)	0.252
Neutrophils [103/µl]	4240 (3290–5540)	5010 (3690–7120)	**< 0.001**
Lymphocytes [103/µl]	2040 (1470–2640)	1490 (980–2020)	**< 0.001**
MPV (fl)	10.1 (9.6–10.7)	10.2 (9.5–10.9)	0.594
CRP [mg/dl]	4.7 (2.3–10.1)	22.6 (5.0–72.7)	**< 0.001**
Albumin [mg/dl]	4.12 (3.96–4.31)	3.30 (2.70–3.95)	**< 0.001**
Prealbumin [mg/dl]	0.29 (0.23–0.31)	0.13 (0.08–0.22)	**< 0.001**
Hb [g/dl]	14.5 (13.7–15.5)	11.9 (10.3–13.3)	**< 0.001**
Platelets [103/µl]	254 (211–300)	254 (187–315)	0.611
Glucose [mg/dl]	99 (87–126)	103 (88–142)	0.375

BUN – blood urea nitrogen, Ca – calcium, Cl – chlorine, CRP – C-reactive protein, Hb – hemoglobin, K – potassium, Mg – magnesium, MPV – mean platelet volume, Na – sodium, P – phosphorus
Statistically significant parameters are indicated in bold.

Table 3. Diagnostic value, specificity, and sensitivity of baseline biomarkers in geriatric palliative care patients

Parameters	Cut-off value	AUC (95% CI)	Specificity (%)	Sensitivity (%)	*p*-value
BUN [mg/dl]	> 22.5	0.603 (0.546–0.660)	44.8	79.2	0.001
Na [mEq/l]	< 138	0.640 (0.584–0.696)	87.7	40.7	< 0.001
K [mEq/l]	< 4.1	0.577 (0.520–0.634)	79.2	41.9	0.014
Ca [mg/dl]	< 9.04	0.780 (0.735–0.826)	80.0	66.7	< 0.001
Mg [mg/dl]	< 1.75	0.584 (0.527–0.642)	76.9	44.4	0.007
Cl [mmol/l]	< 105	0.686 (0.634–739)	72.3	40.6	< 0.001
Neutrophil count [103/µl]	> 7.69	0.610 (0.553–0667)	22.8	96.9	< 0.001
Lymphocyte count [103/µl]	< 1.67	0.692 (0.638–0.746)	68.5	63.9	< 0.001
CRP [mg/l]	> 16.5	0.752 (0.704–0801)	56.4	88.5	< 0.001
Albumin [mg/dl]	< 3.74	0.826 (0.785–0.867)	90.8	69.7	< 0.001
Prealbumin [mg/dl]	< 0.175	0.839 (0.798–0.879)	92.3	63.9	< 0.001
Hb [g/dl]	< 13.25	0.839 (0.798–0.879)	83.1	74.7	< 0.001

BUN – blood urea nitrogen, Ca – calcium, Cl – chlorine, CRP – C-reactive protein, Hb – hemoglobin, K –potassium, Mg – magnesium, Na – sodium

nutrition. In addition, a 1-unit increase in Ca level reduced the odds of malnutrition by 0.515 fold, a 1-unit increase in Cl level by 0.924 fold, and a 1-unit increase in Hb level by 0.657 fold, while a 1-unit increase in prealbumin level reduced the odds of malnutrition (Table 4).

DISCUSSION

As in the rest of the world, the need for palliative care centers is increasing in our country. However, the numbers of palliative care centers and studies on this subject are still lower than expected. There-

Table 4. Univariate and multivariate logistic regression analyses of comorbidities and admission laboratory values as malnutrition risk factors in geriatric palliative care patients

Parameters	Univariate logistic regression OR (95% CI)	*p*-value	Multivariate logistic regression OR (95% CI)	*p*-value
Demographic characteristics				
Age	1.089 (1.052–1.128)	**< 0.001**		**0.007**
Gender, female	1.708 (1.109–2.631)	**0.015**	2.543 (1.285–5.034)	
Comorbidities				
CVD	5.897 (2.281–15.247)	**< 0.001**		
Malignancy	5.897 (2.055–16.917)	**< 0.001**		
Dementia	5.740 (2.218–14.853)	**< 0.001**		
CHF	1.955 (1.030–3.710)	**0.040**		
Number of drugs used	1.128 (1.040–1.223)	**0.004**		
Biomarker				
BUN	1.040 (1.019–1.062)	**< 0.001**		
Na	0.978 (0.939–1.019)	0.283		
F	0.656 (0.464–0.929)	**0.018**		
Ca [mg/dl]	0.210 (0.140–0.317)	**< 0.001**	0.515 (0.298–0.889)	**0.017**
Mg	0.372 (0.161–0.858)	**0.020**		
Cl	0.904 (0.863–0.947)	**< 0.001**	0.924 (0.858–0.996)	**0.040**
Uric acid	0.946 (0.863–1.038)	0.241		
Neutrophil count [103/µl]	1.000 (1.000–1.001)	0.105		
Lymphocyte count [103/µl]	0.980 (0.999–1.062)	0.204		
CRP [mg/l]	1.043 (1.028–1.058)	**< 0.001**		
Albumin [mg/dl]	0.076 (0.042–0.138)	**< 0.001**		
Prealbumin [mg/dl]	< 0.001 (< 0.001–0.000014)	**< 0.001**	< 0.001 (< 0.001–0.001)	**< 0.001**
Hb [g/dl]	0.508 (0.435–0.593)	**< 0.001**	0.657 (0.547–0.788)	**< 0.001**

BUN – blood urea nitrogen, Ca – calcium, CHF – congestive heart failure, Cl – chlorine, CRP – C-reactive protein, CVD – cerebrovascular disease, Hb – hemoglobin, K – potassium, Mg – magnesium, Na – sodium
Statistically significant parameters are indicated in bold.

fore, in our study we aimed to identify factors associated with malnutrition in geriatric palliative care patients. Malnutrition was detected in a majority of the geriatric patients followed in our palliative care unit. Female gender, Hb, and especially prealbumin emerged as important determinants of malnutrition.

Malnutrition has physiological, social, and economic consequences [16]. Previous studies have shown that one in four older patients and half of inpatients have malnutrition [2]. A study of older people in Denmark revealed a relationship between malnutrition and the frequency of hospitalization [17]. Other clinical consequences of malnutrition include nosocomial pneumonia [18] and an increase in the number of falls and fractures [19]. At the same time, many diseases are exacerbated by malnutrition [20, 21]. This leads to a vicious cycle in malnutrition. For these reasons, early detection of malnutrition is extremely important. However, studies have shown that malnutrition is underdiagnosed and undertreated [22].

In our study, the prevalence of malnutrition according to the GNRI was found to be 64.8% among 371 geriatric palliative care patients. In a recent study including 319 patients in our country, patients receiving palliative care were screened according to the nutrition risk screening 2002 and malnutrition was detected in 58.6% of the patients [23]. Another study conducted among 136 geriatric palliative care patients in our country showed that 39.7% of the patients had malnutrition and 47.1% were at risk of malnutrition [24]. In studies conducted among patients receiving long-term care, this rate varied widely between 12.5% and 78.9% [25, 26]. Most patients in our study were immobile. Like other geriatric syndromes, malnutrition is multifactorial and overlaps with many factors. Age-related changes in the musculoskeletal and neurological systems lead to sarcopenia, which also increases the frequency of malnutrition [27]. The different results obtained in our study compared to the literature may be related to methodological differences, concomitant diseases, and the inclusion of only older patients.

Serum albumin is a negative acute phase reactant often used as an inflammation marker. In fact, albumin level decreases secondary to acute and chronic inflammation due to reduced production in the liver, leading to the formation of capillary links [28, 29]. Therefore, it is not a good indicator in the assessment of nutritional status, especially in older inpatients [30]. There is little evidence in the literature that serum albumin level is a marker of malnutrition. In a meta-analysis of 63 studies including a total of 2125 healthy individuals, it was found that fasting had no effect on serum albumin levels [31]. Similarly, in a study involving 14 people diagnosed with anorexia nervosa and 15 healthy individuals, patients were followed for one year and no difference in serum albumin levels was observed between the control and patient groups [32]. Another study showed that a serum albumin level of < 3.5 g/dl had low specificity in the detection of malnutrition in functionally dependent older patients [33], meaning that assessment based on this parameter would lead to false positives in these individuals. In addition, it has been reported that change in body posture (supine vs. sitting after moderate exercise) significantly altered serum albumin levels [34].

Like albumin, prealbumin is a negative acute phase reactant synthesized by the liver. As a result, its level is altered in conditions such as infection and liver disease. However, prealbumin has a half-life of 2–3 days, which is much shorter than that of albumin, so it is more frequently used as an indicator of malnutrition. Because prealbumin is excreted by the kidneys, however, its concentration will increase in renal failure. Moreover, as one of the functions of prealbumin is binding to thyroxine, levels are higher in patients with hypothyroidism [35]. In our study, prealbumin was the most sensitive biomarker at a cut-off value of 0.175 mg/dl.

Anemia is prevalent in older adults, and malnutrition and the risk of malnutrition are also associated with a higher frequency of anemia [36]. Consistent with the literature, our study demonstrated that the presence of anemia increased the risk of malnutrition.

In our study, the frequency of malnutrition was 2.5 times higher in women than in men. Other studies have also shown that women more frequently experience anorexia and are more prone to malnutrition [37]. A recent study conducted in Saudi Arabia also showed that malnutrition was more frequent in women [38]. However, other studies have indicated the opposite. In a study conducted by Méndez *et al*. [39], the rate of malnutrition was found to be higher in men. These differences in results may be attributable to geographic regional and cultural differences.

The strength of our study is that it was carried out prospectively and used validated nutrition assessment tools. However, it also has some limitations. The first of these is that the study was conducted in a single center. Another is that repeated measures were not performed to evaluate changes in the laboratory parameters evaluated at admission. Finally, the study did not examine demographic and social risk factors that can have an impact on malnutrition.

CONCLUSIONS

The prevalence of malnutrition was found to be high among geriatric palliative care patients in our study. Screening for and early detection of malnutrition in geriatric patients receiving palliative care will be beneficial. The geriatric nutritional risk index can be used to diagnose malnutrition in immobile older palliative care patients and may be applied in routine patient follow-up to help improve quality of life.

The authors declare no conflict of interest.

REFERENCES

1. Karaca AS, Seven MM, Gokce A, Yüce BH. The effect of nutritional status on quality of life in palliative care patients. Indian J Surgery 2020; 82: 492-496.
2. Volkert D, Beck AM, Cederholm T, et al. ESPEN guideline on clinical nutrition and hydration in geriatrics. Clin Nutr 2019; 38: 10-47.
3. Agarwal E, Miller M, Yaxley A, Isenring E. Malnutrition in the elderly: a narrative review. Maturitas 2013; 76: 296-302.
4. Abd-El-Gawad WM, Abou-Hashem RM, El Maraghy MO, Amin GE. The validity of Geriatric Nutrition Risk Index: simple tool for prediction of nutritional-related complication of hospitalized elderly patients. Comparison with mini nutritional assessment. Clin Nutr 2014; 33: 1108-1116.
5. Vivanti A, Ward N, Haines T. Nutritional status and associations with falls, balance, mobility and functionality during hospital admission. J Nutr Health Aging 2011; 15: 388-391.
6. Da Silva Alexandre T, de Oliveira Duarte YA, Ferreira Santos JL, Wong R, Lebrão ML. Sarcopenia according to the european working group on sarcopenia in older people (EWGSOP) versus Dynapenia as a risk factor for disability in the elderly. J Nutr Health Aging 2014; 18: 547-553.
7. Abd Aziz NAS, Fahmi Teng NIM, Abdul Hamid MR, Ismail NH. Assessing the nutritional status of hospitalized elderly. Clin Interv Aging 2017; 12: 1615-1625.
8. Van Bokhorst-de van der Schueren MAE, Guaitoli PR, Jansma EP, de Vet HCW. A systematic review of malnutrition screening tools for the nursing home setting. J Am Med Dir Assoc 2014; 15: 171-184.
9. Drescher T, Singler K, Ulrich A, et al. Comparison of two malnutrition risk screening methods (MNA and NRS 2002) and their association with markers of protein malnutrition in geriatric hospitalized patients. Eur J Clin Nutr 2010; 64: 887-893.
10. Cederholm T, Barazzoni R, Austin P, et al. ESPEN guidelines on definitions and terminology of clinical nutrition. Clin Nutr 2017; 36: 49-64.

11. Orlandoni P, Venturini C, Peladic NJ, et al. Malnutrition upon Hospital Admission in Geriatric Patients: why assess it? Front Nutr 2017; 4: 50.
12. Cereda E. Mini nutritional assessment. Curr Opin Clin Nutr Metab Care 2012; 15: 29-41.
13. Bouillanne O, Morineau G, Dupont C, et al. Geriatric Nutritional Risk Index: a new index for evaluating at-risk elderly medical patients. Am J Clin Nutr 2005; 82: 777-783.
14. Guigoz Y, Vellas B, Garry PJ. Assessing the nutritional status of the elderly: the mini nutritional assessment as part of the geriatric evaluation. Nutr Rev 1996; 54: S59-65.
15. Sarikaya D, Halil M, Kuyumcu ME, et al. Mini nutritional assessment test long and short form are valid screening tools in Turkish older adults. Arch Gerontol Geriatr 2015; 61: 56-60.
16. Norman K, Pichard C, Lochs H, Pirlich M. Prognostic impact of disease-related malnutrition. Clin Nutr 2008; 27: 5-15.
17. Beck AM, Ovesen L, Schroll M. A six months' prospective follow-up of 65+-y-old patients from general practice classified according to nutritional risk by the mini nutritional assessment. Eur J Clin Nutr 2001; 55: 1028-1033.
18. Schilp J, Wijnhoven HAH, Deeg DJH, Visser M. Early determinants for the development of undernutrition in an older general population: Longitudinal Aging Study Amsterdam. Br J Nutr 2011; 106: 708-717.
19. Inoue T, Misu S, Tanaka T, Kakehi T, Ono R. Acute phase nutritional screening tool associated with functional outcomes of hip fracture patients: alongitudinal study to compare MNA-SF, MUST, NRS-2002 and GNRI. Clin Nutr 2019; 38: 220-226.
20. Gingrich A, Volkert D, Kiesswetter E, et al. Prevalence and overlap of sarcopenia, frailty, cachexia and malnutrition in older medical inpatients. BMC Geriatr 2019; 19: 120.
21. Wei K, Nyunt MSZ, Gao Q, Wee SL, Yap KB, Ng TP. Association of frailty and malnutrition with long-term functional and mortality outcomes among community-dwelling older adults: results from the Singapore longitudinal aging study 1. JAMA Netw Open 2018; 1: e180650.
22. Seiler WO. Clinical pictures of malnutrition in ill elderly subjects. Nutrition 2001; 17: 496-498.
23. Yürüyen M, Tevetoğlu IÖ, Tekmen Y, Polat Ö. Prognostic factors and clinical features in palliative care patients. Konuralp Med J 2018; 10: 74-80.
24. Efendioglu EM, Cigiloglu A, Turkbeyler IH. Malnutrition and depressive symptoms in elderly palliative care patients. J Palliat Care 2022; 37: 503-509.
25. Pezzana A, Cereda E, Avagnina P, et al. Nutritional care needs in elderly residents of long-term care institutions: potential implications for policies. J Nutr Health Aging 2015; 19: 947-954.
26. Lelovics Z. [Nutritional status and nutritional rehabilitation of elderly people living in long-term care institutions]. Orv Hetil 2009; 150: 2028-2036.
27. Ha L, Hauge T, Spenning AB, Iversen PO. Individual, nutritional support prevents undernutrition, increases muscle strength and improves QoL among elderly at nutritional risk hospitalized for acute stroke: a randomized, controlled trial. Clin Nutr 2010; 29: 567-573.
28. Johnson AM. Low levels of plasma proteins: malnutrition or inflammation? Clin Chem Lab Med 1999; 37: 91-96.
29. Fuhrman MP, Charney P, Mueller CM. Hepatic proteins and nutrition assessment. J Am Diet Assoc 2004; 104: 1258-1264.
30. Rosenthal AJ, Sanders KM, McMurtry CT, et al. Is malnutrition overdiagnosed in older hospitalized patients? Association between the soluble interleukin-2 receptor and serum markers of malnutrition. J Gerontol A Biol Sci Med Sci 1998; 53: M81-6.
31. Lee JL, Oh ES, Lee RW, Finucane TE. Serum albumin and prealbumin in calorically restricted, nondiseased individuals: a systematic review. Am J Med 2015; 128: 1023 e1-22.
32. Haluzik M, KábrtJ, Nedvídková J, Svobodová J, Kotrlíková E, Papezová H. Relationship of serum leptin levels and selected nutritional parameters in patients with protein-caloric malnutrition. Nutrition 1999; 15: 829-833.
33. Kuzuya M, Izawa S, Enoki H, Okada K, Iguchi A. Is serum albumin a good marker for malnutrition in the physically impaired elderly? Clin Nutr 2007; 26: 84-90.
34. Hyltoft Petersen P, Felding P, Hørder M, Tryding N. Effects of posture on concentrations of serum proteins in healthy adults. Dependence on the molecular size of proteins. Scand J Clin Lab Invest 1980; 40: 623-628.
35. Raguso CA, Dupertuis YM, Pichard C. The role of visceral proteins in the nutritional assessment of intensive care unit patients. Curr Opin Clin Nutr Metab Care 2003; 6: 211-216.
36. Sahin S, Tasar PT, Simsek H, et al. Prevalence of anemia and malnutrition and their association in elderly nursing home residents. Aging Clin Exp Res 2016; 28: 857-862.
37. Reijnierse EM, Trappenburg MC, Leter MJ, et al. The association between parameters of malnutrition and diagnostic measures of sarcopenia in geriatric outpatients. PLoS One 2015; 10: e0135933.
38. Alzahrani SH, El Sayed IA, Alshamrani SM. Prevalence and factors associated with geriatric malnutrition in an outpatient clinic of a teaching hospital in Jeddah, Saudi Arabia. Ann Saudi Med 2016; 36: 346-351.
39. Méndez Estévez E, Pita JR, Domínguez JF, et al. Tienen nuestros ancianos un adecuado estado nutricional? Influye su institucionalización? Nutr Hosp 2013; 28: 903-913.