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MEDICAL SCIENCES / DAHİLİ TIP BİLİMLERİ

Relationship of Frailty and Nutritional Status with Laboratory Parameters in Older Adults Admitted to the Emergency Department

Acil Servise Başvuran Yaşlılarda Kırılganlık ve Beslenme Durumunun Laboratuvar Parametreleri ile İlişkisi

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Abstract

Objectives: Frailty and malnutrition in older adults are associated with many adverse outcomes. Our study aimed to compare malnutrition and frailty scales and laboratory test results in older adults admitted to the emergency department

Materials and Methods: This single-center cross-sectional study was conducted in the emergency department of a university hospital. The frailty status of the patients was evaluated with the clinical frailty scale (CFS), and the patients were grouped as frail and non-frail. Mini nutritional assessment-short form (MNA-SF) evaluated malnutrition status. The patients were grouped as malnourished, malnutrition risky, and normal nutritional status. In addition to the basic biochemical parameters of the patients, prealbumin, iron, fasting insulin, hemoglobin a1c, vitamin B12, and parathyroid hormone levels were measured. The relationship between laboratory results and CFS and MNA-SF results was analyzed statistically.

Results: One hundred-six patients were included in the study. Sixty-six patients were female, and the mean age was 78.1±7.43 years. According to the CFS scale, 87.7% of the patients were found to be frail. According to MNA-SF, the rate of patients was 18.9% malnourished and 47.2% at risk of malnutrition. When the scales and laboratory results were compared, frail patients had lower levels of prealbumin, iron, total protein, hemoglobin, and sodium, which was statistically significant. In malnourished patients, prealbumin, fasting insulin, total protein, albumin, hemoglobin, and calcium levels were lower.

Conclusion: In our study, we think that laboratory parameters can help in the early diagnosis of frailty and malnutrition.

Keywords: Frailty, malnutrition, older adults, emergency medicine

Öz

Amaç: Yaşlı yetişkinlerde kırılganlık ve yetersiz beslenme birçok olumsuz sonuçla ilişkilidir. Çalışmamızda acil servise başvuran yaşlı yetişkinlerde malnütrisyon ve kırılganlık ölçekleri ile laboratuvar test sonuçlarının karşılaştırılması amaçlandı.

Gereç ve Yöntem: Bu tek merkezli kesitsel çalışma bir üniversite hastanesinin acil servisinde gerçekleştirildi. Hastaların kırılganlık durumu klinik kırılganlık ölçeği (CFS) ile değerlendirildi ve hastalar kırılgan ve kırılgan olmayan olarak gruplandırıldı. Mini beslenme değerlendirmesi-kısa formu (MNA-SF) yetersiz beslenme durumunu değerlendirdi. Hastalar malnütrisyonlu, malnütrisyon riskli ve beslenme durumu normal olarak gruplandırıldı. Hastaların temel biyokimyasal parametrelerinin yanı sıra prealbümin, demir, açlık insülini, hemoglobin a1c, B12 vitamini ve paratiroid hormon düzeyleri ölçüldü. Laboratuvar sonuçları ile CFS ve MNA-SF sonuçları arasındaki ilişki istatistiksel olarak analiz edildi.

Bulgular: Çalışmaya 106 hasta dahil edildi. Hastaların 66'sı kadındı ve yaş ortalaması 78,1±7,43 yıldı. CFS skalasına göre hastaların %87,7'sinin kırılgan olduğu belirlendi. MNA-SF'ye göre yetersiz beslenen hastaların oranı yüzde 18,9, yetersiz beslenme riski taşıyanların oranı ise yüzde 47,2 oldu. Ölçekler ve laboratuvar sonuçları karşılaştırıldığında, kırılgan hastalarda prealbümin, demir, total protein, hemoglobin ve sodyum düzeyleri istatistiksel olarak anlamlı derecede düşüktü. Yetersiz beslenen hastalarda prealbümin, açlık insülini, toplam protein, albümin, hemoglobin ve kalsiyum düzeyleri daha düşüktü.

Sonuç: Çalışmamızda laboratuvar parametrelerinin kırılganlık ve malnütrisyonun erken teşhisinde yardımcı olabileceğini düşünüyoruz.

Anahtar Kelimeler: Kırılganlık, malnütrisyon, yaşlılar, acil tıp

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Introduction

Older adults are defined as individuals aged 65 and over (1). Thanks to the developments in medicine, the number and rate of older adults are increasing in all countries, and the number of older adults is expected to double by 2050 (2). The term "geriatric syndrome" is used to emphasize the characteristics of the health status of older adults (3). The most common geriatric syndromes are frailty, malnutrition, depression, falls, sarcopenia, dementia, dizziness, multiple drug use, urinary incontinence, and pressure ulcers (4,5). Among these syndromes, frailty, and malnutrition are thought to be the most critical factors in increased morbidity and mortality (6).

Frailty is a state of increased vulnerability to poor resolution of homeostasis after a stressor (7). Many scoring systems, such as modified frailty index, FRAIL scale, and clinical frailty scale (CFS), have defined frailty (8). CFS is based on functional status and underlying comorbidities (9). CFS has advantages over other scales in assessing vulnerability, such as ease of implementation and no requirements for complex surveys. It was also demonstrated that the CFS serves as a rapid, reliable, and valid screening tool for assessing frailty in Turkish older adults (10).

Malnutrition is a decrease in the physical and cognitive functions of the body due to deficiencies in nutrient intake (11). Several scales such as nutritional risk screening, mini nutritional assessment-short Form (MNA-SF), and malnutrition universal screening tool are used to determine malnutrition (12,13). The MNA-SF demonstrated a sensitivity of 94% and a specificity of 81% for malnutrition screening in Turkish older adults, indicating its effectiveness as a diagnostic tool for this demographic (14).

In the literature, studies concerning the relationship between malnutrition and frailty scores and laboratory parameters such as D-dimer, fibrinogen, hemoglobin, albumin, prealbumin, total lymphocyte count, vitamin B12, or folate have been widely published (8,15,16). However, some parameters have not yet been included; iron, parathyroid hormone (PTH), insulin, and hemoglobin a1c (HbA1c) may relate to malnutrition and frailty. Literature studies show that frailty and malnutrition are associated with adverse outcomes such as falls, functional decline, emergency department (ED) admission, hospitalization, and mortality (17,18). Early detection of older adults at risk of experiencing such adverse outcomes may facilitate timely and targeted intervention. An easily reproducible and objective parameter may lead to the management of frail or malnourished older adults. Therefore, we aimed to compare the malnutrition and frailty scales and laboratory test results in older adults admitted to the ED.

Materials and Methods

Study Design and Setting

This cross-sectional and prospective study, a single-center, was conducted in the ED of a tertiary university hospital. Patients aged 65 and over, admitted to the ED between 01.09.2022 and 01.11.2022, with traumatic or non-traumatic reasons, were included in the study. The study was approved by the Local Ethics Committee of Ankara University Faculty of Medicine (IRB number: I07-424-22).

Patients aged 65 and over, regardless of gender, who could act independently or with support and whose consent to participate in the study could be obtained from themselves or their legal guardians, were included in the study. Patients with moderate to severe Alzheimer's/dementia who received treatment for malignancy in the last six months, were immobile, had multiple traumas, and did not want to participate were excluded from the study. Age, gender, alcohol and smoking habits, medication use, and comorbid diseases in the population group were recorded. The frailty status of the patients was evaluated with CFS. Patients with a score of four or more on the CFS were considered frail.

The malnutrition status of the patients was evaluated with MNA-SF. If the total score obtained from MNA-SF was between 0 and 7, the patient was considered malnourished; if it was between 8-11, the patient was considered to be at risk of malnutrition; and if it was between 12-14, the patient was considered not malnourished.

In addition to the blood tests taken related to the patient's complaints on admission to the ED, prealbumin, iron, fasting insulin, HgA1c, vitamin B12, and PTH levels were measured without any additional charge from the patients or their social service institutions.

Statistical Analysis

IBM SPSS Statistics 26.0 program was used to analyze the data. Frequency and percentage, mean and standard deviation, and median (minimum and maximum or interquartile distribution range) were calculated as descriptive statistics. For comparisons between groups, chi-square or Fisher's exact chi-square test for categorical variables, Student's t-test for continuous variables or post-hoc Tukey test with One-Way Analysis of Variance, Mann-Whitney U or Kruskal-Wallis for non-normally distributed and ordinal variables Wallis analysis of variance was used. If there was a difference between the groups due to Kruskal-Wallis analysis of variance, Dunn's test was used to determine which group differed from which. Pearson's or Spearman's correlation coefficient was used to determine the relationship's direction and strength between the variables. Multiple logistic regression

analysis was applied to determine the factors affecting outcome variables. The odds ratio and 95% confidence interval were used as correlation coefficients. Those with a p-value less than 0.05 were considered statistically significant.

Results

A total of 106 patients were included in the study. The flow chart of the patients included in the study is shown in Figure 1.

Of the 106 patients included in the study, 66 were female, 40 were male, and the mean age was 78.1±7.43 years. While 1 (0.9%) of the patients used alcohol, 7 (6.6%) were active smokers. Calcium channel blockers and oral anti-diabetic were the most commonly used drugs. The most common diseases were hypertension (n=92, 86.8%), diabetes mellitus (n=42, 35.6%), congestive heart failure (n=40, 37.7%), asthma/chronic obstructive pulmonary disease (n=27, 25.5%), coronary artery disease (n=33, 31.1%), moderate/severe renal disease (n=29, 27.4%). Among other diseases, cerebrovascular disease (n=7,6.6%), dementia (n=5, 4.7%), depression (n=4, 3.8%), peripheral vascular disease (n=4, 3.8%), rheumatological disease (n=2, 1.9%), peptic ulcer (n=3, 2.8%), non-metastatic tumor (n=9, 8.5%), leukemia (n=2, 1.9%), lymphoma (n=2, 1.9%), moderate/severe liver disease (n=1, 0.9%) and, metastatic tumor (n=5, 4.7%) were less frequent diagnosed diseases (Table 1).

The number of patients considered frail according to the CFS scale was 93 (87.7%). According to MNA-SF, the number of patients with a score between 0-7 and accepted as malnourished was found to be 20 (18.9%), and the number of patients with a score between 8-11 and accepted as at risk of malnutrition was found to be 50 (47.2%).

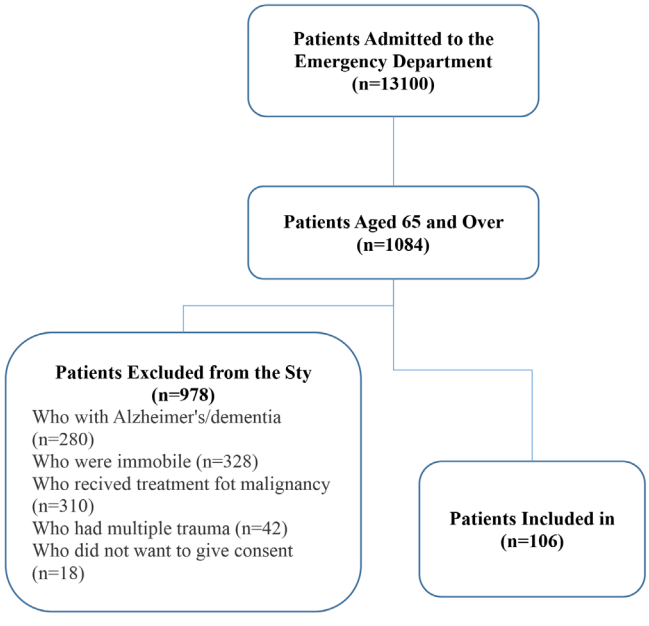

Figure 1: Flow chart of the study

When comparing laboratory parameters with CFS a statistically significant correlation was found for prealbumin (r=-0.31, p=0.03), iron (r=-0.24, p=0.04), total protein (r=-0.42, p=0.01), hemoglobin (r=-0.40, p=0.01), and sodium (r=-0.19, p=0.01). Frail patients had lower prealbumin, iron, total protein, hemoglobin, and sodium levels (Table 2).

Table 1: Demographic data of the patients

	n (%)
Total number of patients	106 (100)
Age (median± SD)	78.1±7.43
Gender	
Woman	66 (62.3)
Man	40 (37.7)
Alcohol use	
Yes	1 (0.9)
No	105 (99.1)
Smoking	
Yes	7 (6.6)
No	99 (93.4)
Medications	
Statin	29 (27.4)
Furosemide	32 (30.2)
Thiazide	36 (34.0)
Calcium channel blocker	45 (42.5)
OAD	38 (35.8)
PPI	3 (2.8)
Warfarin	4 (3.8)
Comorbid diseases	
CHF	40 (37.7)
Asthma/COPD	27 (25.5)
HT	92 (86.8)
MI	33 (31.1)
Moderate/severe kidney disease	29 (27.4)
DM	42 (24.5)
Others	36 (34.0)
CFS	
Frail	93 (87.7)
Not frail	13 (12.3)
MNA-SF	
0-7 malnourished	20 (18.9)
8-11 risk of malnourished	50 (47.2)
12-14 normal nutritional status	36 (34.0)

CHF: Congestive heart failure, COPD: Chronic Obstructive pulmonary disease, DM: Diabetes mellitus, HT: Hypertension, CFS: Clinical frailty scale, MNA-SF: Mini nutritional assessment-short form, SD: Standard deviation, OAD: Oral anti-diabetic, PPI: Proton pump inhibitor

Laboratory parameters were compared with one of the malnutrition scales, MNA-SF. Median values and interquartile range of the laboratory parameters of patients were malnourished (MNA-SF=0), at risk of malnutrition (MNA-SF=1), and normal nutritional status (MNA-SF=2) according to MNA-SF, and p values are shown in Table 3. After finding statistically significant results, pairwise comparisons were made.

When MNA-SF and low prealbumin levels were compared, a statistically significant difference was found between malnourished patients and those at risk of malnutrition and patients with normal nutritional status. When MNA-SF was associated with low fasting insulin, a statistically significant relationship was found between malnourished patients and patients with normal nutritional status. When MNA-SF was compared with low total protein and low hemoglobin value, a statistically significant difference was found between patients with normal nutritional status and those with malnutrition risk and malnourished. When the low albumin level was compared with MNA-SF, a statistically significant difference was found about low albumin between the three nutritional groups. A statistically significant difference was found between malnourished patients and patients with normal nutritional status in the relationship between low calcium value and MNA-SF. There was no statistically significant difference between MNA-SF and values of low iron, HgA1c, total lymphocyte count, fasting blood glucose, magnesium and sodium, and high vitamin B12, PTH, D-dimer, neutrophil-lymphocyte ratio, creatinine clearance (CrCl) and phosphorus. In malnourished patients, prealbumin, fasting insulin, total protein, albumin, hemoglobin, and calcium levels were lower (Table 3).

The univariate logistic regression analysis indicated that prealbumin, total protein, hemoglobin, and fasting blood glucose levels showed significant relationships with CFS and prealbumin, total protein, albumin, hemoglobin, and calcium levels showed significant associations with MNA-SF ($p<0.05$) (Table 4).

Table 2: Participants' characteristics by CFS subgroups

	Not frail patients	Frail patients	p value
Age (mean ± SD)	74.38±7.78	78.66±7.26	0.59
Gender n, (%)			
Female	6 (46.2%)	60 (64.5%)	0.2
Male	7 (53.8%)	33 (35.5%)	
Laboratory parameters (median/IQR)			
Prealbumin (g/L)	0.23/0.07	0.17/0.11	**0.03**
Iron (µg/dL)	64/64	41/43	**0.04**
Fasting insulin (µIU/mL)	11.9/12.3	9.4/13.8	0.58
Vitamin B12 (pg/mL)	330/225.5	383/371	0.13
HbA1c (%)	6.1/1.0	6.1/1.4	0.41
Parathormone (pg/mL)	59/56	54/63	0.58
Total protein (g/L)	70.3/8.6	63.3/12.6	**<0.01**
Albumin (g/L)	42.0/6.0	38.10/7.7	0.08
D-dimer (ng/mL)	455/695	462/606	0.90
Total lymphocyte count ($x10^{n9}$/L)	1.95/1.34	1.39/1.06	0.06
Neutrophil lymphocyte ratio	3.09/2.45	4.24/5.55	0.06
Hemoglobin (g/dL)	13.0/2.9	11.3/3.1	**<0.01**
Fasting blood glucose (mg/dL)	102/46	124/47	0.15
CrCl (mg/dL)	66/37	55/41	0.38
Calcium (mg/dL)	9.0/1.0	8.8/0.81	0.09
Phosphorus (mg/dL)	2.93/1.37	3.64/1.75	0.08
Magnesium (mg/dL)	1.98/0.25	1.88/0.40	0.17
Sodium (mmol/L)	137/3	136/4	**<0.01**

IQR: Interquartile range, CFS: Clinical frailty scale, HbA1c: Hemoglobin A1c, CrCl: Creatinine clearance, SD: Standard deviation

Table 3: Participants' characteristics by MNA-SF subgroups				
	Malnourished	**At risk of malnutrition**	**Normal nutritional status**	**p value**
Age (mean ± SD)	80.65±6.65	78.76±7.44	76.03±7.38	0.61
Gender n, (%)				
Female	11 (55%)	32 (64%)	23 (63.9%)	0.75
Male	9 (45%)	18 (36%)	13 (36.1%)	
Laboratory parameters (median/IQR)				
Prealbumin (g/L)	0.12/0.06	0.17/0.11	0.19/0.07	(MNA-SF 0-1) **0.03**
				(MNA-SF 0-2) <**0.01**
				(MNA-SF 1-2) 0.47
Iron (µg/dL)	33/27	45.5/50	49.5/49	0.08
Fasting insulin (µIU/mL)	5.6/6	9.8/12.9	13.65/14.7	(MNA-SF 0-1) 0.05
				(MNA-SF 0-2) <**0.01**
				(MNA-SF 1-2) 0.28
Vitamin B12 (pg/mL)	385/627	387/448	324/242	0.19
HbA1c (%)	5.15/1.7	6.20/1.4	6.10/1.1	0.81
Parathormone (pg/mL)	55.5/171	58/65	52.5/42	0.88
Total protein (g/L)	58.75/8.9	61.1/12.7	69.3/5.4	(MNA-SF 0-1) 0.76
				(MNA-SF 0-2) <**0.01**
				(MNA-SF 1-2) <**0.01**
Albumin (g/L)	31.55/8.5	37.55/7.4	41.1/4.1	(MNA-SF 0-1) <**0.01**
				(MNA-SF 0-2) <**0.01**
				(MNA-SF 1-2) <**0.01**
D-dimer (ng/mL)	637/1317	386/749	449/478	0.10
Total lymphocyte count (x10^{n9}/L)	1.06/0.87	1.37/1.05	1.57/0.88	0.11
Neutrophil lymphocyte ratio	6.07/7.17	4.04/5.18	3.60/4.26	0.33
Hemoglobin (g/dL)	10.75/3.3	11.15/2.0	12.95/2.8	(MNA-SF 0-1) 0.73
				(MNA-SF 0-2) <**0.01**
				(MNA-SF 1-2) <**0.01**
Fasting blood glucose (mg/dL)	112.5/89	129/60	121/34	0.15
CrCl (mg/dL)	49.5/48	57/40	64.5/42	0.59
Calcium (mg/dL)	8.65/1.92	8.8/0.11	9.05/0.70	(MNA-SF 0-1) 0.74
				(MNA-SF 0-2) **0.03**
				(MNA-SF 1-2) 0.05
Phosphorus (mg/dL)	3.69/1.58	3.67/2.01	3.20/1.22	0.05
Magnesium (mg/dL)	1.82/0.26	1.92/0.42	1.98/0.36	0.59
Sodium (mmol/L)	136/6	136/4	137/3	0.65

IQR: Interquartile range, MNA-SF: Mini nutritional assessment-short form, MNA-SF=0: Malnourished, MNA-SF=1: At risk of malnutrition, MNA-SF=2: Normal nutritional status, HbA1c: Hemoglobin A1c, CrCl: Creatinine clearance, SD: Standard deviation

Discussion

Frailty and malnutrition are significant problems that affect the level of independence and quality of life in older adults. Early diagnosis of these syndromes with the help of easy-to-access laboratory parameters may help further management of these patients. In our study, older adults who were considered frail according to CFS had lower prealbumin, iron, total protein, hemoglobin, and sodium levels; and patients who were deemed malnourished according to the MNA-SF scale had lower prealbumin, fasting insulin, total protein, albumin, hemoglobin, and calcium levels.

CFS is a common scale used in vulnerability screening. In our study, 87.7% of the patients were found to be frail, according to CFS.

Table 4: Laboratory parameters associated with CFS and MNA-SF by univariate logistic regression analysis						
	CFS			MNA-SF		
	OR	95% CI	p-value	OR	95% CI	p value
Prealbumin (g/L)						
<0.18 vs. 0.18-0.38	7.28	1.52-34.73	**<0.01**	2.65	1.15-6.09	**0.02**
Iron (µg/dL)						
<37 vs. 37-145	2.51	0.65-9.74	0.18	1.32	0.57-3.03	0.50
Fasting insulin (µIU/mL)						
<4 vs. 4-16	3.06	0.35-26.26	0.30	4.13	0.86-19.87	0.07
>16 vs. 4-16	1.19	0.32-4.32	0.79	0.48	0.19-1.18	0.11
Vitamin B12 (pg/mL)						
<197 vs. 197-771	0.49	0.11-2.05	0.33	1.03	0.32-3.28	0.95
HbA1c (%)						
<4 vs. 4-6	1.08	0.33-3.48	0.88	1.00	0.44-2.26	0.98
Parathormone (pg/mL)						
<15 vs. 15-65	0.88	0.27-2.82	0.83	1.32	0.58-3.00	0.50
Total protein (g/L)						
<64 vs 64-83	6.39	1.34-30.45	**0.02**	12.67	4.35-36.86	**<0.01**
Albumin (g/L)						
<35 vs. 35-52	2.20	0.56-8.54	0.25	6.20	2.16-17.79	**<0.01**
D-dimer (ng/mL)						
0 vs. 0-243	1.20	0.34-4.27	0.76	1.55	0.64-3.76	0.32
Total lymphocyte count (x10^{n9}/L)						
<1.5 vs. 1.5-4	3.25	0.93-11.34	0.06	1.67	0.74-3.77	0.21
Hemoglobin (g/dL)						
<11.7 vs. 11.7-16.1	6.97	1.46-33.23	**<0.01**	3.62	1.53-8.52	**<0.01**
Fasting blood glucose (mg/dL)						
<74 vs. 74-106	3.55	1.08-11.64	**0.03**	1.44	0.60-3.46	0.41
CrCl (mg/dL)						
<60 vs. 60-120	0.98	0.96-1	0.15	1.62	0.63-2.8	0.56
Calcium (mg/dL)						
<8.6 vs. 8.6-10.2	1.29	0.33-5.07	0.71	4.44	1.40-14.01	**<0.01**
Phosphorus (mg/dL)						
<2.5 vs. 2.5-4.5	0.51	0.11-2.25	0.37	0.62	0.19-1.99	0.42
>4.5 vs. 2.5-4.5	1.74	0.34-8.85	0.49	3.59	1.11-11.62	**0.03**
Magnesium (mg/dL)	NA			2.509	0.66-9.45	0.17
Sodium (mmol/L)	NA			1.773	0.72-4.34	0.21

CFS: Clinical frailty scale, MNA-SF: Mini nutritional assessment-short form, OR: Odds ratio, CI: Confidence interval, CrCl: Creatinine clearance, HbA1c: Hemoglobin A1c, NA: Not available

On the other hand, Kaeppeli et al. (19) found the frailty rate to be 37% in a study conducted on 2,393 older adults admitted to the ED. Collard et al. (20) reported that the frailty rate ranged from 4.0 to 59.1% in a systematic review. Xu et al. (8) found that frailty can vary depending on gender, age, comorbidity, medication used, and trauma history. Our findings revealed a higher frailty rate than reported in existing literature, which we attribute to several factors. First, the study was conducted during the Coronavirus disease-2019 pandemic, a period when individuals aged 65 and older had restricted mobility, only leaving their homes for critical reasons. Second, frail older adults patients may experience extended stays in the ED, increasing their likelihood of participating in the study. Third, our ED, being a tertiary referral center, encounters a significant number of frail older adults patients with multiple comorbidities.

Protein intake is fundamental to healthy aging; frailty and its negative consequences increase in low protein intakes (21).

Hong et al. (16) and Xu et al. (8) found a statistically significant relationship between the decrease in total protein and the increase in frailty. Çevik et al. (22) also found that 71.2% of the malnourished patients had low total protein and that there was a statistically significant relationship between decreased total protein and increased malnutrition. Similar to the studies, we found that low total protein level was associated with a nearly six-fold increased risk of developing frailty and a twelve-fold increased risk of malnutrition.

Immunoglobulins (Ig) constitute about 20% of the total protein and are essential for the immune system's defense against pathogenic microorganisms (23). A meta-analysis by Khan et al. (24) revealed that older adults have reduced levels of IgM and IgG compared to their younger counterparts. Older adults with low total protein levels, who are at increased risk of frailty and malnutrition, are consequently more vulnerable to a range of complications, including infections and autoimmune disorders.

Low serum albumin, another body protein, was quite common in patients in the study group (18.9% of those with malnutrition, 47.2% of those at risk of malnutrition). Wu et al. (25) also found a statistically significant relationship between frailty and low albumin. In addition, a similar association was shown in a meta-analysis in 2020 (26). When we look at the relationship between malnutrition and low albumin, Çevik et al. (22) and Vallentini et al. (27) found a statistically significant relationship between malnutrition and low albumin. Li et al. (28) also showed that low prealbumin increased frailty. In our study, low prealbumin level was associated with an almost seven-fold increased risk of developing frailty and a two-fold increased risk of malnutrition. Based on all these results, we think that low albumin, total protein, and prealbumin can be used to predict both frailty and malnutrition.

One of the critical problems in older adults is anemia. Anemia is defined as a low level of hemoglobin that carries oxygen. Palmer et al. (29), in the systemic research they conducted, stated that there was a relationship between low hemoglobin and frailty, and frailty rate was calculated as 24% in patients with low hemoglobin. Sahin et al. (30) also showed a statistically significant relationship between malnutrition and low hemoglobin. In our study, low hemoglobin level was associated with a nearly seven-fold increased risk of developing frailty and a four-fold increased risk of malnutrition.

PTH is an important hormone that plays a role in calcium and vitamin D metabolism. In addition, PTH has functions such as regulation of bone formation. To investigate its effect on frailty, Pillatt et al. (31) found no statistically significant relationship between PTH and frailty. Although it was high in most frail patients in our study, we did not find a statistically significant relationship between frailty and PTH, similar to Pillatt et al. (31).

While vitamin B12 deficiency can be encountered with problems such as forgetfulness and numbness in the hands, studies have also shown that B12 deficiency is an element of malnutrition. Çevik et al. (22) found a statistically significant relationship between malnutrition and vitamin B12 deficiency. However, our results could not strengthen Çevik et al. (22) results since there was no significant relation between malnutrition and vitamin B12 deficiency.

The number of nephrons, renal blood flow, and glomerular filtration rate decrease with aging (32). Studies by Pillatt et al. (31) and Çevik et al. (22) reported no statistically significant association between creatinine levels and malnutrition or frailty. Given that creatinine concentrations are affected by multiple factors -including sex, age, diet, and the stage of renal impairment- relying solely on creatinine levels may introduce a margin of error when assessing renal function in older adults. Consequently, in our study, CrCl was used as the primary measure of kidney function, and no significant relationship was identified between CrCl and frailty or malnutrition. This finding is consistent with results from Yanagita et al. (33), who also observed no association between CrCl and frailty.

A notable strength of our study is its comprehensive comparison of the CFS and MNA-SF against a wide array of laboratory parameters, such as iron, PTH, fasting insulin, and HbA1c. This comparison was further supported by thorough statistical analysis utilizing logistic regression.

Study Limitations

Our study has several limitations. These can be listed as the fact that the study was conducted in a single center, there was only one researcher in data collection, the sample size was small, and there was no gold standard in evaluating frailty and malnutrition.

Conclusion

Our study demonstrated that the CFS and MNA-SF are associated with a range of laboratory parameters. When time for patient assessment is constrained in the ED, it may be beneficial for physicians to recognize that specific laboratory parameters could signal frailty or malnutrition in older adults.

Ethics

Ethics Committee Approval: Ankara University Faculty of Medicine Ethics Committee (I07-424-22). This study was performed in accordance with the 1964 Declaration of Helsinki and its later amendments.

Informed Consent: Informed consent was obtained from all individual participants included in this study.

Footnotes

Authorship Contributions

Concept: M.Ö.D., Y.Ç., O.P., Design: S.G., A.K., M.G., A.B.O., Data Collection or Processing: M.Ö.D., Y.Ç., Analysis or Interpretation: Y.Ç., O.P., Literature Search: M.Ö.D., Y.Ç., S.G., Writing: M.Ö.D., Y.Ç., A.K., O.P., S.G., M.G., A.B.O.

Conflict of Interest: No conflict of interest was declared by the authors.

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References

1. Orimo H. [Reviewing the definition of elderly]. Nihon Ronen Igakkai Zasshi. 2006;43:27-34. Japanese.
2. Lim SC, Doshi V, Castasus B, et al. Factors causing delay in discharge of elderly patients in an acute care hospital. Ann Acad Med Singap. 2006;35:27-32.
3. Inouye SK, Studenski S, Tinetti ME, et al. Geriatric Syndromes: Clinical, Research, and Policy Implications of a Core Geriatric Concept. J Am Geriatr Soc. 2007;55:780-791.
4. Yang YC, Lin MH, Wang CS, et al. Geriatric syndromes and quality of life in older adults with diabetes. Geriatr Gerontol Int. 2019;19:518-524.
5. Magnuson A, Sattar S, Nightingale G, et al. A practical guide to geriatric syndromes in older adults with cancer: a focus on falls, cognition, polypharmacy, and depression. Am Soc Clin Oncol Educ Book. 2019;39:e96-e109.
6. Patel KV, Brennan KL, Brennan ML, et al. Association of a modified frailty index with mortality after femoral neck fracture in patients aged 60 years and older. Clin Orthop Relat Res. 2014;472:1010-1017.
7. Clegg A, Young J, Iliffe S, et al. Frailty in elderly people. Lancet. 2013;381:752-762.
8. Xu L, Zhang J, Shen S, et al. Clinical frailty scale and biomarkers for assessing frailty in elder inpatients in China. J Nutr Health Aging. 2021;25:77-83.
9. Rockwood K, Song X, MacKnight C, et al. A global clinical measure of fitness and frailty in elderly people. Cmaj. 2005;173:489-495.
10. 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.
11. Meza-Valderrama D, Marco E, Dávalos-Yerovi V, et al. Sarcopenia, malnutrition, and cachexia: adapting definitions and terminology of nutritional disorders in older people with cancer. Nutrients. 2021;13:761.
12. Ye XJ, Ji YB, Ma BW, et al. Comparison of three common nutritional screening tools with the new European Society for Clinical Nutrition and Metabolism (ESPEN) criteria for malnutrition among patients with geriatric gastrointestinal cancer: a prospective study in China. BMJ Open. 2018;8:e019750.
13. Planas M, Álvarez-Hernández J, León-Sanz M, et al. Prevalence of hospital malnutrition in cancer patients: a sub-analysis of the PREDyCES® study. Support Care Cancer. 2016;24:429-435.
14. Özsürekci C, Balcı C, Kızılarslanoğlu MC, et al. An important problem in an aging country: identifying the frailty via 9 Point Clinical Frailty Scale. Acta Clin Belg. 2020;75:200-204.
15. Kane RL, Talley KM, Shamliyan T, et al. Common Syndromes in Older Adults Related to Primary and Secondary Prevention. AHRQ. 2011.
16. Hong X, Yan J, Xu L, et al. Relationship between nutritional status and frailty in hospitalized older patients. Clin Interv Aging. 2019:105-111.
17. Ensrud KE, Ewing SK, Cawthon PM, et al. A comparison of frailty indexes for the prediction of falls, disability, fractures, and mortality in older men. J Am Geriatr Soc. 2009;57:492-498.
18. Cunha AIL, Veronese N, de Melo Borges S, et al. Frailty as a predictor of adverse outcomes in hospitalized older adults: a systematic review and meta-analysis. Ageing Res Rev. 2019;56:100960.
19. Kaeppeli T, Rueegg M, Dreher-Hummel T, et al. Validation of the clinical frailty scale for prediction of thirty-day mortality in the emergency department. Ann Emerg Med. 2020;76:291-300.
20. Collard RM, Boter H, Schoevers RA, et al. Prevalence of frailty in community-dwelling older persons: a systematic review. J Am Geriatr Soc. 2012;60:1487-1492.
21. Bartali B, Frongillo EA, Bandinelli S, et al. Low nutrient intake is an essential component of frailty in older persons. J Gerontol A Biol Sci Med Sci. 2006;61:589-593.
22. Çevik A, Basat O, Sema U. Evde sağlık hizmeti alan yaşlı hastalarda beslenme durumunun değerlendirilmesi ve beslenme durumunun laboratuar parametreleri üzerine olan etkisinin irdelenmesi. Konuralp Tıp Derg. 2014;6:31-37.
23. Listì F, Candore G, Modica MA, et al. A study of serum immunoglobulin levels in elderly persons that provides new insights into B cell immunosenescence. Ann N Y Acad Sci. 2006;1089:487-495.
24. Khan SR, Van der Burgh AC, Peeters RP, et al. Determinants of serum immunoglobulin levels: a systematic review and meta-analysis. Front Immunol. 2021;12:664526.
25. Wu IC, Shiesh SC, Kuo PH, et al. High oxidative stress is correlated with frailty in elderly chinese. J Am Geriatr Soc. 2009;57:1666-1671.
26. Mailliez A, Guilbaud A, Puisieux F, et al. Circulating biomarkers characterizing physical frailty: CRP, hemoglobin, albumin, 25OHD and free testosterone as best biomarkers. Results of a meta-analysis. Exp Gerontol. 2020;139:111014.
27. Valentini A, Federici M, Cianfarani MA, et al. Frailty and nutritional status in older people: the Mini Nutritional Assessment as a screening tool for the identification of frail subjects. Clin Interv Aging. 2018:1237-1244.
28. Li C, Chen XM, Li Y, et al. Factors and outcome of renal osteodystrophy-associated initial fragility fracture in end-stage renal disease patients. Kidney Dis. 2019;5:118-125.
29. Palmer K, Vetrano DL, Marengoni A, et al. The relationship between anaemia and frailty: a systematic review and meta-analysis of observational studies. J Nutr Health Aging. 2018;22:965-974.
30. 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.
31. Pillatt AP, Da Silva B, Franz LBB, et al. Muscle, endocrine, and immunological markers of frailty in older people. Exp Gerontol. 2021;151:111405.
32. Beck LH. Changes in renal function with aging. Clin Geriatr Med. 1998;14:199-210.
33. Yanagita I, Fujihara Y, Eda T, et al. Low glycated hemoglobin level is associated with severity of frailty in Japanese elderly diabetes patients. J Diabetes Investig. 2018;9:419-425.