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Examination of osteosarcopenia in patients over 65 years old with hip fracture

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ABSTRACT

OBJECTIVE: There is limited knowledge regarding the clinical, biochemical, and functional characteristics of patients with osteosarcopenia. The present study aims to explore the presence of osteosarcopenia in patients aged 65 years and over who have a history of falls and hip fractures.

METHODS: Seventy-six participants (77.6% women) aged 65 years and over (mean age 81±6.75 years) were admitted to the orthopedic clinic of our hospital due to hip fracture. The diagnosis of osteopenia/osteoporosis was established based on the bone mineral density measurement using dual-energy X-ray absorptiometry. The SARC-F scale was used to screen patients for sarcopenia. The muscle mass was determined by the appendicular lean mass (ALM). The muscle strength was evaluated by the handgrip strength. SPSS for Windows 25.0 (IBM Statistical Package for Social Sciences) software package was used in the statistical analysis of the study data.

RESULTS: A total of 76 patients were evaluated, including 59 (77.6%) females and 17 (22.4%) males. The mean age of the patients was 81±6.75 years. The prevalence of osteosarcopenia in the entire study group was 36.8%. The prevalence rate was higher in males (59%) than in females (30.5%) ($p<0.05$). The ALM and the handgrip strength were lower in patients with osteosarcopenia ($p<0.05$). The mean body weight, total fat mass, fat mass index, and upper arm circumference were the lowest in the group of patients with osteosarcopenia ($p<0.05$).

CONCLUSION: The present study found that the prevalence of osteosarcopenia was higher in patients with hip fracture. There is a limited number of studies in literature directly evaluating the relationship between osteosarcopenia and hip fracture. The presence of osteosarcopenia is often overlooked when the bone fracture is the prevailing clinical condition. Osteosarcopenia is frequently the accompanying diagnosis in patients with hip fracture.

Keywords: Hip fracture, osteoporosis; osteosarcopenia.

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The clinical conditions involving atypical symptoms or signs commonly seen in the elderly in recent years that are considered to be related to senescence either directly or indirectly have been termed as geriatric syndromes. Although there is no consensus on the definition of geriatric syndromes, the au-

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thors have reached a consensus on common geriatric syndromes such as malnutrition, immobilization, incontinence, depression, delirium, dementia, falls, gait disorders, pain, osteoporosis, sarcopenia, frailty, and decubitus ulcers [1].

Sarcopenia is a geriatric syndrome defined as an age-related decline in muscle mass, muscle strength, and muscle functions. This syndrome significantly impairs the life quality of patients and results in unfavorable conditions such as a decrease in the mobility of the patients, falls, and an increase in dependency on others [2].

Osteoporosis is another significant health concern specific to the aging process. The importance of osteoporosis has increased due to an increase in the life expectancy and growing elderly population.

The World Health Organization (WHO) defined osteoporosis as a systemic silent skeletal disease characterized by low bone mass and microstructural breakdown of bone, causing bones to become fragile and increasing a person's fracture risk [3]. Presently, dual-energy X-ray absorptiometry (DEXA) is the gold standard method in evaluating regional or total bone mineral density (BMD). The measurement of bone mineral density using DEXA is a non-invasive, sensitive, and useful method of detecting short- and long-term bone fracture risk [4].

Recent studies have reported an increase in the frail patient population in parallel to an increase in the elderly population worldwide, and the studies have concurrently suggested a possible relationship between the combination of osteopenia/osteoporosis and sarcopenia and the risk of falls and fracture and the need for admission to the hospital [5, 6]. The combination of osteoporosis and sarcopenia, both of which increase the risk of falls and fracture, has been termed osteosarcopenia [2]. There is a lack of knowledge regarding clinical, biochemical, and functional characteristics of osteosarcopenic patients. In one study, osteosarcopenia was defined as a clinical condition in the falling elderly population to determine clinical, functional, and biochemical characteristics specific to this population [5]. In another study, osteoporosis and sarcopenia are linked to nutritional deficits and reduced function in geriatric inpatients. Co-occurrence (osteosarcopenia) is common and associated with a higher degree of malnutrition than osteoporosis or sarcopenia alone [7]. The present study aims to investigate the presence of osteosarcopenia in patients older than 65 years who were admitted to our hospital due to hip fracture.

Highlight key points

- The prevalence of osteosarcopenia is increased in older patients with hip fracture.
- Similar to osteoporosis, osteosarcopenia is also a prevalent phenomenon in geriatric patients with hip fracture.
- Sarcopenia is not specific to slim patients as it is anticipated.

MATERIALS AND METHODS

The present cross-sectional study was conducted on patients admitted to the Department of Orthopedics in our hospital between January 2018 and December 2019. The power analysis revealed a minimum sample size of 76 patients with a power of 0.80 and an alpha of 0.05 when the effect size for the handgrip strength was taken as 0.39126 with an SD of 10.2.

The study was granted approval by the Umraniye Training and Research Hospital ethics committee with decision number 174, dated December 21, 2017. All participating patients and their relatives provided written informed consent. The study was conducted in accordance with the Declaration of Helsinki.

The study included a total of 76 patients aged 65 years and older who were admitted to the orthopedic clinic due to hip fracture. The history of muscle disease and advanced dementia were determined as exclusion criteria.

A detailed medical history was obtained from the patients, and all underwent physical examination (weight before fracture, height, BMI, upper arm circumference, and calf circumference measurements) and blood chemistry (parathormone [PTH], calcium, phosphorus, thyroid-stimulating hormone [TSH], creatinine, albumin, 25-Hydroxyvitamin D) was obtained. Fasting blood samples were obtained between 08:00 AM and 10:00 AM for the blood tests. Calcium and phosphorus concentrations were measured using an enzymatic colorimetric test; creatinine was measured by the Jaffe reaction; 25-Hydroxyvitamin D was measured by the high-performance liquid chromatography method; and PTH, TSH, and albumin were measured by chemiluminescence immunoassay.

The reference range was 3.2–4.6 g/dL for albumin, 8.4–10.2 mg/dL for calcium, 2.8–4 mg/dL for phosphorus, 0.57–1.11 mg/dL for creatinine, 18.5–88 pg/mL for PTH, 0.35–4.94 uIU/mL for TSH, and 25–100 ng/mL for 25-Hydroxyvitamin D.

The presence of osteopenia/osteoporosis was determined by measuring the bone mineral density (BMD) using DEXA (Hologic, Horizon brand, 2016, USA). The total "t" scores of the patients were taken into consideration. The muscle mass was determined by measuring "body composition" using the DEXA to evaluate the appendicular lean mass (ALM). The ALM cut-off value in diagnosing sarcopenia was 7 kg/m² males and 5.5 kg/m² for females [8].

The handgrip strength was determined using the Jamar hand dynamometer. While the patients were in an upright sitting position with the dominant arm's elbow flexed 90 degrees, three measurements were obtained at 10-second intervals, and the average of three measurements was recorded. The cut-off value was 27 kg for males and 16 kg for females [8].

The SARC-F scale was used to screen patients for sarcopenia [9, 10]. Scoring is made on 5 criteria: strength, assistance in walking, rise from a chair, climb stairs and falls in the last year. The total score is between 0–10. Scores of 4 and above predict sarcopenia and poor prognosis.

The FRAIL scale was used to evaluate the frailty of the patients [11]. Scoring is made on 5 criteria: fatigue, resistance, ambulation, illness, loss of weight. The total score is between 0–5. The patients were divided into three groups based on their scores: normal (0 points), pre-frail (1–2 points), frail (3–5 points).

The Mini Nutritional Assessment (MNA) Short-Form was used to evaluate the patients' nutritional status [12]. The patients were divided into three groups based on the malnutrition indicator score: malnourished (0–7 points), at risk of malnutrition (8–11 points), normal nutritional status (12–14 points).

Furthermore, the Survey of Activities and Fear of Falling in the Elderly (SAFE) was used to evaluate the fear of falling [13]. The responses to eleven questions were rated on a scale of 1–4 points, and the average of the responses was recorded. The final score ranges from 0 to 3 points and reflects the fear of falling.

TABLE 1. Distribution of the patients (n=76)

	%
Bone mineral density	
Normal	32.9
Osteopenia	25
Osteoporosis	42.1
Muscle mass	
Normal	48.7
Sarcopenia*	51.3
Bone and muscle mass	
Normal	18.4
Osteopenia/osteoporosis	30.3
Sarcopenia	14.5
Osteosarcopenia	36.8
Nutritional status	
Normal nutritional status	64.5
At risk of malnutrition	28.9
Malnourished	6.6
Frailty status	
Not frail	21.1
Pre-frail	63.2
Frail	15.8
BMI	
Underweight	6.6
Normal weight	36.8
Overweight	28.9
Obese	27.6

*: Patients with a low ALM and/or handgrip strength; ALM: Appendicular lean mass; BMI: Body Mass Index;

Statistical Analysis

SPSS for Windows 25.0 software package (IBM Statistical Package for Social Sciences, New York, USA) was used in the statistical analysis of the study data. A Kolmogorov-Smirnov test was used to test whether the data was normally distributed. The continuous variables were expressed using descriptive statistics such as mean, standard deviation, minimum, median, and maximum. A Student's t-test was used to compare two independent, normally distributed variables. A chi-square test (or Fisher's exact test as appropriate) was used to evaluate the relationship between categorical variables. One-way analysis of variance (ANOVA) was used to compare normally distributed parameters between multiple groups. A chi-square test was used in the comparison of qualitative data. The correlation between two continuous variables without normal distribution was evaluated using Pearson's correlation coefficient. The level of statistical significance was set at an alpha of 0.05.

Table 2. Distribution of various patient characteristics across the four groups

	Normal	Sarcopenia	Osteoporosis	Osteosarcopenia
SAFE, (Mean±SD)	0.3±0.22	0.6±0.62	0.4±0.42	0.4±0.48
Total body fat, (Mean±SD)	41.2±6.48	37.1±7.54	42.9±6.74	36.5±7.96
Fat mass/ height^2, (Mean±SD)	12.9±4.03	8.8±3.24	12.8±3.53	8.4±3.27
Upper arm circumference, (Mean±SD)	27.5±4.21	24.9±4.18	26.3±4.84	23.2±4.07
Calf circumference, (Mean±SD)	32.5±4.16	30.6±5.67	31.7±5.62	29.8±3.85
Number of falls in the last one year, (Mean±SD)	0.9±0.82	1.2±0.90	0.8±0.77	1.1±1.18
Gender, (%)				
Female	85.7	63.6	95.7	64.3
Male	14.3	36.4	4.3	35.7
SARC-F, (%)				
Normal	28.6	54.5	65.2	46.4
Symptomatic	71.4	45.5	34.8	53.6
Normal	100.0	100.0	0.0	0.0
T score, (%)				
Osteopenia	0.0	0.0	34.8	39.3
Osteoporosis	0.0	0.0	65.2	60.7
Normal	100.0	18.2	100.0	3.6
Appendicular lean/height^2, (%)				
Normal	100.0	18.2	100.0	3.6
Sarcopenia	0.0	81.8	0.0	96.4
Hand grip strength, (%)				
Normal	100.0	27.3	91.3	10.7
Low	0.0	72.7	8.7	89.3

SAFE: Survey of activities and fear of falling in the elderly; SARC-F: Strength, assistance with walking, rise from a chair, climb stairs and falls; SD: Standard deviation; BMI: Body mass index; MNA: Mini nutritional assessment.

RESULTS

A total of 76 patients participated in the study, including 59 (77.6%) females and 17 (22.4%) males. The mean age of the patients was 81±6.75 years, with a range of 67 to 95 years.

As shown in Table 1, the patients were divided into groups according to bone mineral density, muscle mass, malnutrition status, frailty status, and BMI, resulting in four groups created according to muscle mass and bone mineral density: 14 patients (18.4%) in the normal group, 23 patients (30.3%) in the osteopenia/osteoporosis group, 11 patients (14.5%) in the sarcopenia group, and 28 patients (36.8%) in the osteosarcopenia group.

As shown in Table 2, the prevalence of osteosarcopenia was 30.5% in females and 59% in males. The majority of females (37.2%) were in the isolated osteopenia/osteoporosis group, and the majority of males (58.8%) were in the osteosarcopenia group.

Of osteosarcopenic patients, 84.7% had normal or higher weight. As expected, the aLM index and the handgrip strength were the lowest in the osteosarcopenia group (Table 2).

As shown in Table 3, when the categorical variables were evaluated, statistically significant differences were found in the parameters of gender, aLM index, and handgrip strength ($p<0.05$). Osteosarcopenia was more common in males. Handgrip strength was the lowest in the osteosarcopenia group and when the patients were classified according to the aLM index, the aLM index was found to be lower in the participants in the osteosarcopenic group.

TABLE 3. The results of the Chi-Square Test evaluating the relationship between categorical variables

	Normal (%)	Sarcopenia (%)	Osteopenia/osteoporosis (%)	Osteosarcopenia (%)	p
Gender					**0.03**
Female	85.7	63.6	95.7	64.3	
Male	14.3	36.4	4.3	35.7	
Marital status					0.52
Married	78.6	54.5	56.5	64.3	
Widow	21.4	45.5	43.5	35.7	
SARC-F					0.17
Normal	28.6	54.5	65.2	46.4	
Symptomatic	71.4	45.5	34.8	53.6	
Appendicular lean/height^2					**0.00**
Normal	100.0	18.2	100.0	3.6	
Sarcopenia	0.0	81.8	0.0	96.4	
Handgrip strength					**0.00**
Normal	100.0	27.3	91.3	10.7	
Low	0.0	72.7	8.7	89.3	
Hypertension					0.08
Absent	57.1	45.5	17.4	35.7	
Present	42.9	54.5	82.6	64.3	
Pulmonary disease					0.11
Absent	64.3	100.0	65.2	78.6	
Present	35.7	0.0	34.8	21.4	

SARC-F: Strength, assistance with walking, rise from a chair, climb stairs and falls.

As shown in Table 4, the mean weight, total fat mass, fat mass index (fat mass/height^2), aLM index, handgrip strength, and upper arm circumference were the lowest in the osteosarcopenia group, followed by the isolated sarcopenia group ($p<0.05$).

The study found no statistically significant difference in the analysis of MNA, FRAIL, SARC-F scores, comorbidities and laboratory tests. A Pearson's correlation coefficient was used to determine the relationship between the aLM index and total T score and other parameters, and these data are shown in Table 5. There was a positive correlation between the aLM index and fat mass index, upper arm circumference, calf circumference, BMI and weight, while a negative correlation was found between the aLM index and phosphorus and albumin. There was a positive correlation between the total T score and BMI and weight, while a negative correlation was found between the total T score and phosphorus and age.

A Pearson's correlation coefficient calculated to evaluate the relationship between total T score and aLM index showed no statistically significant relationship between these two parameters.

DISCUSSION

The present study evaluated the presence of osteosarcopenia in the elderly population admitted to the hospital due to hip fracture and found that 36.8% of the patients had osteosarcopenia. The prevalence of osteosarcopenia was previously evaluated only in a few studies. The prevalence of osteosarcopenia was reported to be 27.2% in a Korean study evaluating the prevalence of osteosarcopenia and the relationship between 1-year mortality and the presence of osteosarcopenia in patients with hip fracture aged 60 years and older; a study involving frail patients and investigating the physical performance and bone metabolism in osteosarcopenic patients in the Ger-

Table 4. The results of the t-test evaluating the relationship between numeric variables

Group	n	Mean±SD	p
Weight			**0.00**
Normal	14	71.8±11.7	
Sarcopenia	11	60.8±11.1	
Osteopenia/osteoporosis	23	72.3±12	
Osteosarcopenia	28	61±12.4	
Total body fat			**0.01**
Normal	14	41.2±6.48	
Sarcopenia	11	37.1±7.54	
Osteopenia/osteoporosis	23	42.9±6.74	
Osteosarcopenia	28	36.5±7.96	
Appendicular lean/height^2			**0.00**
Normal	14	7.1±1.12	
Sarcopenia	11	5.2±0.60	
Osteopenia/osteoporosis	23	6.8±2.30	
Osteosarcopenia	28	5.2±0.77	
Handgrip strength			**0.00**
Normal	14	22.2±6.35	
Sarcopenia	11	21±16.46	
Osteopenia/osteoporosis	23	21.7±9.14	
Osteosarcopenia	28	15±7.98	
Fat mass/height^2			**0.00**
Normal	14	12.9±4.03	
Sarcopenia	11	8.8±3.24	
Osteopenia/osteoporosis	23	12.8±3.53	
Osteosarcopenia	28	8.4±3.27	
Upper arm circumference			**0.01**
Normal	14	27.5±4.21	
Sarcopenia	11	24.9±4.18	
Osteopenia/osteoporosis	23	26.3±4.84	
Osteosarcopenia	28	23.2±4.07	
Osteosarcopenia	28	75.9±50.02	

SD: Standard deviation.

man population reported a prevalence rate of 28%; an Austrian study involving elderly population with a history of falls and aiming to identify clinical, functional and biochemical characteristics specific to this population reported a prevalence rate of 40%; a Chinese study conducted to predict the prevalence of sarco-osteoporosis and evaluating its relationship with frailty reported a prevalence rate of 13%; and a study evaluating the relationship between osteosarcopenia and cardiovascular risk factors in elderly Iranian population reported a prevalence rate of 34% [5, 6, 14–16]. As shown in these studies, the prevalence of osteosarcopenia cannot be underestimated in the older population.

In the present study, 76 participants were divided into four groups according to muscle and bone mass as normal, osteopenia/osteoporosis, sarcopenia, and osteosarcopenia. When these groups were compared in terms of gender, the majority of females (37.2%) were in the isolated osteopenia/osteoporosis group, while only 5.8% of males were in the isolated osteopenia/osteoporosis group. The majority of males (58.8%) were in the osteosarcopenia group. In a study by Reiss et al. [7] involving a portion of the patient population evaluated in the Study on Global Ageing and Adult Health (SAGE), a cross-sectional study evaluating the muscle mass in geriatric patients, osteoporosis was significantly more prevalent in females. In contrast, no significant gender difference was observed in the prevalence of sarcopenia and osteosarcopenia. In the present study, isolated osteopenia/osteoporosis was more common in females, whereas osteosarcopenia was more common in males. These findings are consistent with the findings of a Chinese study involving patients aged 80 years and older [15]. In a study by Huo et al. [5], the patients with osteosarcopenia were more likely to be females than the patients with nonsarcopenia/nonosteopenia, sarcopenia, and osteopenia/osteoporosis. In contrast, the highest proportion of females in the present was noted in the osteopenia/osteoporosis group, with a rate of 95.7%. This was followed by 85.7% in the normal group, 64.3% in the osteosarcopenia group, and 63.6% in the isolated sarcopenia group. In a study involving a patient population aged 60 years and older, Fahimfar et al. [16] reported a prevalence rate of approximately 30% for osteosarcopenia in both genders. In the present study, the prevalence of osteosarcopenia was 30.5% in females and 58.8% in males. When the previous studies are considered, the prevalence of osteosarcopenia is expected to be higher in females. Because the lean body mass, muscle mass, and bone mineral density are lower in females than in males of the same age, this difference increases with increasing age, particularly after menopause. However, the present study found almost two times higher prevalence rates for osteosarcopenia in males than in females.

In their study, Huo et al. [5] showed that osteosarcopenic patients were significantly older than the patients in the nonsarcopenic/nonosteopenic group,

Table 5. Correlation analysis evaluating the relationship between the ALM index, T score, and other parameters

Group	n	Mean±SD	p	Group	n	Mean±SD	p
Appendicular lean/height^2	76	-0.128	0.27	Total T score	76	-0.337	**0.00**
Age				Age			
Appendicular lean/height^2	76	-0.076	0.51	Total T score	76	0.009	0.94
Height				Height			
Appendicular lean/height^2	76	**0.437**	**0.00**	Total T score	76	0.251	**0.02**
Weight				Weight			
Appendicular lean/height^2	76	-0.191	0.09	Total T score	76	0.029	0.80
SAFE				SAFE			
Appendicular lean/height^2	76	0.057	0.62	Total T score	76	0.062	0.59
Total body fat				Total body fat			
Appendicular lean/height^2	76	**0.436**	**0.00**	Total T score	76	0.196	0.09
(Fat mass)/height^2				(Fat mass)/height^2			
Appendicular lean/height^2	76	**0.343**	**0.00**	Total T score	76	-0.214	0.06
Upper arm circumference				Upper arm circumference			
Appendicular lean/height^2	76	**0.459**	**0.00**	Total T score	76	0.221	0.05
Calf circumference				Calf circumference			
Appendicular lean/height^2	76	0.001	0.99	Total T score	76	0.114	0.32
Vitamin D				Vitamin D			
Appendicular lean/height^2	76	-0.076	0.51	Total T score	76	-0.018	0.87
Parathormone				Parathormone			
Appendicular lean/height^2	76	-0.125	0.28	Total T score	76	-0.108	0.35
Calcium				Calcium			
Appendicular lean/height^2	76	**-0.265**	**0.02**	Total T score	76	-0.250	**0.03**
Phosphorus				Phosphorus			
Appendicular lean/height^2	76	0.065	0.57	Total T score	76	-0.019	0.86
Thyroid-stimulating hormone				Thyroid-stimulating hormone			
Appendicular lean/height^2	76	-0.018	0.87	Total T score	76	-0.074	0.52
Creatinine				Creatinine			
Appendicular lean/height^2	76	**-0.291**	**0.01**	Total T score	76	0.111	0.33
Albumin				Albumin			
Appendicular lean/height^2	76	-0.107	0.35	Total T score	76	0.026	0.82
Number of falls in the last one year				Number of falls in the last one year			
Appendicular lean/height^2	76	0.220	0.057	Total T score	76	0.108	0.35
Handgrip strength				Handgrip strength			
Appendicular lean/height^2	76	**0.479**	**0.00**	Total T score	76	**0.255**	**0.02**
BMI				BMI			
Appendicular lean/height^2	59	-0.170	0.19	Total T score	59	-0.082	0.53
Age at menopause				Age at menopause			

ALM: Appendicular lean mass; SAFE: Survey of activities and fear of falling in the elderly; SD: Standard deviation; BMI: Body mass index.

isolated sarcopenia group, and osteopenia/osteoporosis group. The mean age was the highest in the osteopenia/osteoporosis group in the present study, although no significant difference was noted in terms of mean age among these four groups. Similar to that in the present study, osteosarcopenic individuals in the study by Drey et al. [14] were not significantly older than individuals in the osteopenia/osteoporosis and isolated sarcopenia groups. Unlike the present study, some other studies [15, 16] found higher mean age in osteosarcopenic patients than in patients without osteosarcopenia in the two genders.

As anticipated, the aLM index and the handgrip strength were significantly lower in the sarcopenia and osteosarcopenia groups than in the other groups. Similarly, the study by Drey et al. [14] reported significantly lower aLM index and handgrip strength in the osteosarcopenic group than in all other groups, and the study by Reiss et al. [7] reported significantly lower handgrip strength in all pathological groups (sarcopenia, osteopenia, osteosarcopenia) than in the reference group. Similar to the present study, Huo et al. [5] reported the lowest aLM index in the osteosarcopenia group, followed by the isolated sarcopenia group.

In the present study, the lowest mean weight, total fat mass, fat mass index (fat mass/height2), and upper arm circumference were noted in the osteosarcopenia group followed by the isolated sarcopenia group ($p<0.05$). These parameters were comparable in the normal and osteopenia/osteoporosis groups and higher than those in the sarcopenia and osteosarcopenia groups. In a study by Fahimfar et al. [16] conducted in an Iranian population, BMI was shown to have an inverse relationship with osteosarcopenia independently of the gender, while the present study showed no difference between the four groups with respect to BMI. However, the present study showed an inverse relationship between body weight and osteosarcopenia ($p<0.05$). The study by Fehimfar et al. [16] also reported that total fat mass had the strongest relationship with osteosarcopenia among the other studied factors, and the present study found a similar significant relationship between osteosarcopenia and total fat mass and index.

In the analysis of comorbid conditions, the study by Huo et al. [5] showed a significant relationship between osteosarcopenia and the presence of gout compared to nonsarcopenic/nonosteopenic patients; the study by Fahimfar et al. [16] showed a direct relationship between diabetes and osteosarcopenia in the male population, while the present study, contrary to expectations, showed no significant relationship between comorbid conditions and osteosarcopenia. In our study, hypertension was most commonly observed in the osteopenia/osteoporosis group, but hypertension was present in the majority of the participants in all groups other than the normal group, although the difference was not statistically significant.

In a study by Huo et al. [5], the risk of having hyperparathyroidism was higher in patients with osteosarcopenia than in patients with sarcopenia, and the excess of endogenous PTH was demonstrated to be a risk factor for the development of osteopenia/osteoporosis in patients with sarcopenia. In another study [17], patients with elevated PTH levels (24% of the participants) were found to be more likely to be older, have a history of falls, and have low handgrip strength, pace, and bone mass than other participants, and high PTH levels were found to be associated with osteosarcopenia.

The Pearson correlation coefficient calculated to determine the relationship between the aLM index and other parameters showed a significant positive relationship between the aLM index and weight, fat mass index, upper arm circumference, calf circumference, and BMI, and a significant negative relationship between the aLM index and blood phosphorus and albumin levels. A significant positive relationship was found between the total T score and weight and BMI, whereas a significant negative relationship was found between total T score and blood phosphorus level and age. In two different studies published by Di Monaco et al. [18, 19], a significant positive correlation was reported between aLM index and T score. The present study, however, reports no statistically significant relationship between these two parameters.

The present study has some limitations. The participants were selected among older individuals with a history of hip fracture from the general population, and the participants with dementia and muscle disease were excluded from the study. Therefore, the findings of the present study cannot be generalized to the entire elderly population and those living in the nursing homes. Furthermore, the small size of the study population and the majority of the participants being female are other limitations. On the other hand, the present study analyzed individuals who are more likely to have sarcopenia, osteopenia/osteoporosis, or osteo-

sarcopenia by selecting patients admitted to the hospital with a hip fracture. This selection strategy aimed to facilitate defining a particular phenotype for osteosarcopenia.

There is a lack of knowledge in the literature regarding this subject. Although many studies have demonstrated the effects of osteoporosis on fractures [20–24], there are a very limited number of studies evaluating the effect of osteosarcopenia on hip fracture [24, 25]. The present study is worthy as it addresses an area for which there is a paucity of data in the literature. Similar to osteoporosis, osteosarcopenia is also a prevalent phenomenon in these patients. The prevalence of osteosarcopenia was found to be 36.8% in the present study. The prevalence rate was even higher in males. Furthermore, BMI was normal or overweight in 84.7% of osteosarcopenic patients. Sarcopenia is not specific to slim patients as it is anticipated. The high prevalence rate of osteosarcopenia suggests that osteosarcopenia must be kept in mind in patients presenting with a hip fracture.

Conclusion

There is a limited number of studies in literature directly evaluating the relationship between osteosarcopenia and hip fracture. The present study implies the importance of osteosarcopenia in patients with hip fracture. The prevalence of osteosarcopenia is significantly higher in these patients. The presence of osteosarcopenia is often overlooked when the bone fracture is the prevailing clinical condition. Osteosarcopenia is frequently the accompanying diagnosis in patients with hip fracture.

Ethics Committee Approval: The Umraniye Training and Research Hospital Ethics Committee granted approval for this study (date: 21.12.2017, number: 174).

Informed Consent: Written informed consents were obtained from patients who participated in this study.

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