



## Evaluation of Osteoporosis and Osteoporotic Fracture Risk in Men: A Retrospective Study

Erkeklerde Osteoporoz ve Osteoporotik Kırık Riskinin Değerlendirilmesi: Retrospektif Çalışma

Uğur Ertem, Fatma Jale İrdesel

Bursa Uludağ University Faculty of Medicine, Department of Physical Medicine and Rehabilitation, Bursa, Turkey

### Abstract

**Objective:** Osteoporotic fractures can cause important consequences in terms of public health in men and women. In this study, it is aimed to determine the frequency of osteoporosis (OP) and osteoporotic fractures in men and the risk factors that may cause osteoporotic fractures.

**Materials and Methods:** Men over the age of 65 years who were admitted to physical medicine and rehabilitation outpatient clinic with musculoskeletal system pain between 15 March 2021 and 15 September 2021 was included in the study retrospectively. A total of 90 patients were included in this study. Data regarding 25-hydroxyvitamin D<sub>3</sub> [25-(OH)D<sub>3</sub>] levels, body mass index (BMI), age, bone mineral density (BMD) T-scores, smoking and alcohol using status were recorded.

**Results:** The median age of the participants was 71 (66-89) years. Osteoporotic fractures were found in 14 patients (15.5%). Osteoporotic fractures were more common in the vertebral region (71.4%). The patients were divided into the following two groups: group 1 (with osteoporotic fracture) and group 2 (without osteoporotic fracture). Regression analysis revealed that age, and BMI associated with osteoporotic fractures (p<0.05). In contrast, no correlation was found between osteoporotic fracture formation and 25-(OH)D<sub>3</sub> levels, BMD T-scores, smoking, and use of alcohol (p>0.05).

**Conclusion:** OP and osteoporotic fracture formation is a common public health problem in men and women. Because of the negative effects of osteoporotic fractures on society and individuals, it is important to know the risk factors and take precautions against them.

**Keywords:** Fracture, osteoporosis, men

### Öz

**Amaç:** Osteoporotik kırıklar kadın ve erkeklerde halk sağlığı açısından önemli sonuçlara yol açabilmektedir. Bu çalışmada, erkeklerde osteoporoz (OP) ve osteoporotik kırık sıklığının ve osteoporotik kırıklara neden olabilecek risk faktörlerinin belirlenmesi amaçlanmıştır.

**Gereç ve Yöntem:** Fiziksel tıp ve rehabilitasyon polikliniğimize 15 Mart 2021-15 Eylül 2021 tarihleri arasında kas-iskelet sistemi ağrısı ile başvuran 65 yaş üstü erkekler geriye dönük olarak incelendi. Bu çalışmaya toplam 90 hasta dahil edildi. Tüm hastaların 25-hidroksivitamin D<sub>3</sub> [25-(OH)D<sub>3</sub>] düzeyleri, vücut kitle indeksi (VKİ), yaş, kemik mineral yoğunluğu (KMY) T-skorları, sigara ve alkol kullanım durumları ile ilgili veriler kaydedildi.

**Bulgular:** Hastaların ortanca yaşı 71 (66-89) yılı. On dört hastada (%15,5) osteoporotik kırık tespit edildi. Osteoporotik kırıklar vertebral bölgede yoğunlaşmıştı (%71,4). Hastalar iki gruba ayrıldı: Grup 1 (osteoporotik kırıklı) ve grup 2 (osteoporotik kırıksız). Regresyon analizi, yaş ve VKİ'nin osteoporotik kırıklarla ilişkili olduğunu gösterdi (p<0,05). Aksine osteoporotik kırık oluşumu ile 25-(OH)D<sub>3</sub> düzeyleri, KMY T-skorları, sigara ve alkol kullanımı arasında ilişki bulunmadı (p>0,05).

**Sonuç:** OP ve osteoporotik kırık oluşumu kadınlarda ve erkeklerde yaygın bir halk sağlığı sorunudur. Osteoporotik kırıkların toplum ve bireyler üzerindeki olumsuz etkileri nedeniyle risk faktörlerinin bilinmesi ve bunlara karşı önlem alınması önemlidir.

**Anahtar kelimeler:** Kırık, osteoporoz, erkekler

**Address for Correspondence/Yazışma Adresi:** Uğur Ertem MD, Bursa Uludağ University Faculty of Medicine, Department of Physical Medicine and Rehabilitation, Bursa, Turkey

**Phone:** +90 224 295 08 14 **E-mail:** ugurertem@uludag.edu.tr **ORCID ID:** orcid.org/0000-0003-2142-2264

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## Introduction

Osteoporosis (OP) is a metabolic bone disease characterized by decreased bone mass, decreased bone strength, and deterioration in the microarchitecture of bone tissue (1). OP has become one of the most important health problems with the increase in life expectancy today. The main problem in OP is the increased risk of fracture (2). The clinical consequences of this disease require measures to allow timely appropriate intervention and to evaluate high-risk individuals. Many risk factors may be associated with osteoporotic fracture, including female sex, low peak bone mass, history of fracture, cigarette smoking, alcohol drinking, increasing age, white race, low calcium and vitamin D intake (3-5). Even though the risk of fracture is higher in postmenopausal women, osteoporotic fractures can occur in men as well.

Approximately 8 million women in the United States are affected by OP. But OP is not only seen in women, it is common in men as well, with about 4% to 6% of men over the age of 50 having OP, resulting in approximately 2 million cases in the United States (6,7).

Considering that OP is a preventable and treatable disease, it becomes clear how important it is to diagnose OP and predict fracture risk. The diagnosis of OP is based on the measurement of bone mineral density (BMD) (8). OP is defined as a BMD T-score on dual energy X-ray absorptiometry (DXA) machines as  $-2.5$  and lower. Osteopenia is defined as a BMD T-score between  $-1$  and  $-2.5$ .

Calculating the risk of osteoporotic fracture is not as easy as diagnosing OP with BMD. Because the occurrence of osteoporotic fractures can be affected by many risk factors to varying degrees in both men and women. Studies show that at least half of osteoporotic fractures occur in people with osteopenia (9,10). This studies show that it is not possible to predict fracture risk by looking at BMD alone. The FRAX tool is one of the tools developed to predict fracture risk. Combining confirmed clinical risk factors and BMD of the femoral neck, FRAX calculates the 10-year probability of hip or major osteoporotic fractures (9).

In one study found that the main determinants of osteoporotic and hip fracture risk in men were age, body mass index (BMI), smoking, alcohol using, some accompanying diseases, some drugs used, and history of falls. In the same study, it was determined that QFractureScore had a better performance compared to the FRAX algorithm for hip fracture (11). Another study examined the reliability of the FRAX tool in predicting the ten-year fracture risk in patients with systemic autoimmune disease. According to the study results, the FRAX tool accurately predicted fracture probability in patients with rheumatoid arthritis, but was not successful in predicting fracture risk in patients with systemic lupus erythematosus and primary Sjögren's syndrome (12). The FRAX tool is the most commonly used algorithm for assessing the risk of osteoporotic fractures in men and women worldwide (13).

Although OP is very common in men and causes a very important complication such as fracture, most of the studies on

OP and osteoporotic fracture in the literature has focused on postmenopausal women. In our study, we aimed to examine the frequency of OP and osteoporotic fracture in men who applied to the outpatient clinic with musculoskeletal system pain and to determine the risk factors that may cause fracture in patients with OP.

## Materials and Methods

The records of the men over the age of 65 who applied to the physical therapy and rehabilitation outpatient clinic with complaints of musculoskeletal pain between March 15, 2021 and September 15, 2021 were retrospectively scanned through the hospital database. While determining the study population, we did not include patients who did not have DXA or radiography in their outpatient clinic applications or who did not have these tests in an external center. Thus, a total of 90 patients were included in our study.

T-score of  $\leq -2.5$  in femoral total, femoral neck and/or lumbar total vertebra BMD measurements in DXA performed in all patients was considered OP, and a diagnosis between  $-1$  and  $-2.5$  was considered osteopenia. The radiographs of the patients taken in the same hospital or in another center were evaluated by the investigative physicians, and the patients with osteoporotic fractures were recorded together with the fracture sites. In addition, patients' 25-hydroxyvitamin D<sub>3</sub> [25-(OH)D<sub>3</sub>] levels, BMI, age, BMD T-scores, smoking and alcohol using status were recorded.

The patients were divided into two groups according to the presence of osteoporotic fractures. Group 1 was defined as patients with osteoporotic fractures, and group 2 as patients without osteoporotic fracture.

The ethics committee approval for this study was made by Uludağ University Clinical Research Ethics Committee (decision no: 2021-14/7, date: 06.10.2021).

## Statistical Analysis

Shapiro-Wilk test was used to evaluate whether the variables fit the normal distribution or not. Continuous variables were given as median (minimum-maximum) and mean  $\pm$  standard deviation values. Categorical variables were reported as n (%). According to the normality test results, independent sample t-test or Mann-Whitney U test was used in comparison between two groups. Fisher's Exact test was used to compare categorical variables. Binary logistic regression analysis was performed to determine the risk factors affecting osteoporotic fracture risk in men. SPSS (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0, Armonk, NY: IBM Corp.) was used for statistical analysis and p value  $<0.05$  was considered statistically significant.

## Results

The median age of 90 patients was 71 (66-89). OP was detected in 25.5% of the patients, and osteopenia in 54.4%.

A osteoporotic fracture was detected in 14 patients (15.5%). Osteoporotic fractures were concentrated in the vertebral region (71.4%). The clinical and demographic characteristics of the participants are given in Table 1.

When the patients were divided into two groups according to the presence of fracture, a significant relationship was found between advanced age and osteoporotic fracture formation ( $p < 0.05$ ). In addition, a statistically significant relationship was found between low femoral neck, femoral total and lumbar total T-scores and osteoporotic fracture formation ( $p < 0.05$ ). There was no significant difference between BMI, 25-(OH) D<sub>3</sub> levels, smoking and alcohol using status and osteoporotic fracture formation ( $p > 0.05$ ). Comparison of the demographic and clinical characteristics of the patients according to the presence of osteoporotic fractures is shown in Table 2.

In the logistic regression analysis, the model obtained by using the Enter method was found to be significant ( $p = 0.002$ ) and compatible with the data set ( $p = 0.336$ ). It was determined that 1 unit increase in the age of the patients increased the risk of developing osteoporotic fracture 1.17 times, and 1 unit increase in BMI increased the risk of osteoporotic fracture 1.28 times (Table 3).

## Discussion

Determining the incidence of OP in men as in women and the risk factors for osteoporotic fracture formation, which is one of the most important complications of OP, provides important information in the follow-up of these patients. In this study, it was determined that OP is frequently observed in men as well as in women, and osteoporotic fracture formation can be seen at a substantial level.

In the current study, OP was detected in 25.5% of the patients. In a study examining the prevalence of OP in Saudi men, the

**Table 1. Demographic and clinical features of participants**

	n	
Age (years)	90	71 (66-89)
<b>Bone mineral density</b>		
Femoral neck T-score	90	-1.4 (-5.1-1.9)
Femoral total T-score		-0.8 (-5.7-2.5)
Lumbar total T-score		-0.7±1.7
BMI (kg/m <sup>2</sup> )	90	28.0 (19-44.8)
<b>Osteoporosis status</b>		
Osteoporosis	90	23 (25.5%)
Osteopenia		49 (54.4%)
Normal bone density		18 (20%)
<b>Presence of fracture</b>		
Fracture	90	14 (15.5%)
No fracture		76 (84.4%)
<b>Fracture site</b>		
Vertebra fracture	14	10 (71.4%)
Hip fracture		3 (21.4%)
Non-vertebral fracture		1 (7.1%)
25-(OH)D <sub>3</sub> level (ng/mL)	83	20.3 (4.4-55.2)
<b>Current smoker</b>		
Yes	90	10 (11.1%)
No		80 (88.8%)
<b>&gt;3 units of alcohol a day</b>		
Yes	90	2 (2.2%)
No		88 (97.7%)

25-(OH)D<sub>3</sub>: 25-hydroxyvitamin D<sub>3</sub>, BMI: Body mass index, Data are expressed as n (%), median (minimum-maximum) and mean ± standard deviation

**Table 2. Comparison of participants with and without fracture in terms of demographic and clinical characteristics**

	n	Group 1 (with osteoporotic fracture)	n	Group 2 (without osteoporotic fracture)	p-value
Age (years)	14	75 (68-88)	76	70 (66-89)	0.017 <sup>a</sup>
Femoral neck T-score	14	-2.3±1.0	76	-1.4±1.0	<0.001 <sup>b</sup>
Femoral total T-score	14	-1.9±1.4	76	-0.8±1.1	<0.001 <sup>b</sup>
Lumbar total T-score	14	-2.1±1.2	76	-0.7±1.7	0.001 <sup>b</sup>
BMI (kg/m <sup>2</sup> )	14	28.3 (21.8-34.9)	76	28.0 (19.0-44.8)	0.920 <sup>a</sup>
25-(OH)D <sub>3</sub> level (ng/mL)	12	21.2 (8.7-28.1)	71	20.2 (4.4-55.2)	0.741 <sup>a</sup>
<b>Current smoker</b>					
Yes	14	3 (21.4%)	76	7 (9.2%)	0.185 <sup>c</sup>
No		11 (78.5%)		69 (90.7%)	
<b>&gt;3 units of alcohol a day</b>					
Yes	14	1 (7.1%)	76	1 (1.3%)	0.288 <sup>c</sup>
No		13 (92.8%)		75 (98.6%)	

25-(OH)D<sub>3</sub>: 25-hydroxyvitamin D<sub>3</sub>, BMI: Body mass index, Data are expressed as n (%), median (minimum-maximum) and mean ± standard deviation, <sup>a</sup>Mann-Whitney U test, <sup>b</sup>Independent sample t-test, <sup>c</sup>Fisher's Exact test

**Table 3. Factors associated with osteoporotic fracture formation**

	Wald	p-value	OR	95% CI	
				Lower	Upper
Age (years)	4.51	0.034	1.17	1.01	1.36
Femoral neck T-score	0.35	0.555	1.56	0.35	6.88
Femoral total T-score	2.46	0.117	0.29	0.06	1.36
Lumbar total T-score	2.85	0.091	0.57	0.30	1.09
BMI (kg/m <sup>2</sup> )	5.03	0.025	1.28	1.03	1.60
25-(OH)D <sub>3</sub> level (ng/mL)	0.01	0.928	1.00	0.93	1.08
Current smoker (yes)	0.94	0.334	3.02	0.32	28.28
>3 units of alcohol a day (yes)	2.01	0.156	23.68	0.30	1879.22
Model $\chi^2=23.99$ ; p-value=0.002					
Hosmer and Lemeshow test: p-value =0.336					
OR: Odds ratio, CI: Confidence interval, 25-(OH)D <sub>3</sub> : 25-hydroxyvitamin D <sub>3</sub> , BMI: Body mass index, "No" category for current smoker and "no" category for >3 units of alcohol a day were accepted as reference category					

prevalence of osteopenia and OP for the lumbar spine was 35.7% and 21.4%, respectively. The prevalence of osteopenia and OP in the femoral neck was 38% and 11.4%, respectively. In the same study, the overall prevalence of OP was found to be 23.5% (14). In a study investigating the prevalence of osteopenia and OP in human immunodeficiency virus positive male patients, BMD was found to be decreased in 35 (70%) patients, including OP in 19 (38%) patients and osteopenia in 16 (32%) patients (15). In a study evaluating risk factors for OP in elderly men, 209 men over 65 years of age who applied to the geriatrics outpatient clinic were included in the study. As a result of this study, OP was found in 64 (30.6%) patients and osteopenia was found in 92 (44.0%) patients (16). In our study, the frequency of OP was found to be similar to the literature. We think that the reason for the prevalence of OP to be in such a wide range in the studies in the literature is due to the different patient inclusion criteria in each study.

In the current study, as a result of logistic regression analysis, it was determined that the increase in patients' age and BMI increased the risk of osteoporotic fracture. In a study evaluating the distribution of patients with OP who applied to the outpatient clinic, it was found that 88% of OP patients were female and 12% were male. While osteoporotic fractures were detected in 10.3% of male OP patients, no fracture was found in 89.7% of them. Despite the risk of osteoporotic fractures is high in male OP patients, it was determined that this situation was not related to age and OP etiology (17). Fractures due to OP affect 40% of women over 50 and 14% of men. The risk of fracture relates to BMD, age, nutritional factors and the risk of falling (18). In addition, newly formed osteoporotic fractures independently predict new fractures (19). Because of this, we can say that risk of osteoporotic fracture increases in patients with a history of osteoporotic fractures, regardless of gender. Apart from these, an important risk factor for hip fracture due to OP in men is a low BMI level (20). In a study of male patients, higher 25-(OH)D<sub>3</sub> levels were associated with

higher baseline BMD, slower BMD loss, and a lower risk of hip fracture (21). In our study, when each variable was considered independently, BMD subcategories were found to be associated with osteoporotic fracture formation, while inclusion in other variables did not find a relationship between BMD values and osteoporotic fracture formation. On the contrary, BMI was not associated with osteoporotic fracture formation when taken alone, but there was a correlation between BMI and osteoporotic fracture formation with the inclusion of other variables. Increasing age was found to be associated with osteoporotic fracture formation, which supports the literature. We think that the most important factor in the different results from the literature in our study is the fact that many risk factors that may directly or indirectly increase the fracture risk were not evaluated, since the patients were selected retrospectively. In addition, the limited number of patients may have caused our results to differ from the literature in some respects. In general, it is known that low BMI increases the risk of OP. In our study, on the contrary, increase in BMI was found to be associated with an increased risk of osteoporotic fractures. We think that this result is due to the fact that increased BMI may be associated with falling risk.

Current study has limitations. Since it is a retrospective study, conditions that may be risk factors for OP and osteoporotic fractures such as diet, living conditions, activity level, falling risk, OP diagnosis period, medications used and how long the OP-related treatment lasts could not be evaluated. In addition, the fact that it is a single-center study and the limited number of patients are other limitations.

## Conclusion

OP and osteoporotic fracture formation are common public health problems in men as well as women. In this study, it was determined that there was a positive relationship between advanced age, increased BMI and osteoporotic fracture

formation. Strategies to prevent OP and osteoporotic fracture formation are important for improving public health. Therefore, knowing the risk factors in OP and osteoporotic fracture formation and taking precautions against them are important treatment strategies.

### Ethics

**Ethics Committee Approval:** Uludağ University Clinical Research Ethics Committee approval was obtained for the study with the number of 2021-14/7 (date: 06.10.2021). This study adheres to the ethical rules reported in the 1964 Helsinki Declaration, which were revised in 2013.

**Informed Consent:** Retrospective study.

**Peer-review:** Internally peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: U.E., F.J.İ, Concept: U.E., F.J.İ, Design: U.E., F.J.İ, Data Collection or Processing: U.E., F.J.İ, Analysis or Interpretation: U.E., F.J.İ, Literature Search: U.E., F.J.İ, Writing: U.E., F.J.İ

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