

Comparison of vitamin D, parathyroid hormone (PTH), and bone metabolism markers in hip fracture patients by fracture type and control group

✉ Bahattin Kemah,¹ ✉ Mehmet Salih Söylemez,² ✉ Samet Erinç,³ ✉ Korhan Özkan,⁴ ✉ Oğuz Şükrü Poyanlı⁵

¹Department of Orthopaedics and Traumatology, Umraniye Training and Research Hospital, Istanbul-Türkiye

²Department of Orthopaedics and Traumatology, Medistate Hospital, Istanbul-Türkiye

³Department of Orthopaedics and Traumatology, Florya Hospital, Istanbul-Türkiye

⁴Department of Orthopaedics and Traumatology, Ataşehir Acıbadem Hospital, Istanbul-Türkiye

⁵Department of Orthopaedics and Traumatology, Istanbul Medeniyet University, Prof. Dr. Süleyman Yalcin City Hospital, Istanbul-Türkiye

ABSTRACT

BACKGROUND: Vitamin D, calcium, and bone metabolism markers play a critical role in skeletal health; however, their relationship with different hip fracture types remains uncertain. This study aimed to investigate serum levels of 25(OH) vitamin D, calcium, parathyroid hormone (PTH), alkaline phosphatase (ALP), phosphorus, total protein, and albumin in elderly patients with femoral neck fractures (FNF) and intertrochanteric femur fractures (ITFF), compared to a control group.

METHODS: This retrospective study included 375 patients aged 65 years and older, comprising 117 patients with ITFF, 97 with FNF, and 161 control cases (coxarthrosis/gonarthrosis). Serum biochemical parameters were analyzed using standard laboratory methods. Fractures were classified according to the AO/OTA (Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association) system by two independent observers, and interobserver agreement was assessed using Cohen's kappa coefficient ($\kappa=0.89$). Group comparisons were performed using one-way analysis of variance (ANOVA) followed by post hoc Bonferroni tests. A p value <0.05 was considered statistically significant.

RESULTS: Vitamin D levels were significantly lower in both the ITFF and FNF groups compared to controls ($p<0.01$), while no significant difference was observed between the ITFF and FNF groups ($p>0.05$). Similarly, calcium, total protein, and albumin levels were lower in fracture groups than in controls ($p<0.01$). In contrast, PTH levels were significantly higher in patients with fractures ($p=0.001$).

CONCLUSION: Deficiencies in vitamin D and calcium were associated with an increased risk of hip fractures but did not appear to influence fracture pattern. These findings suggest that systemic biochemical parameters should be emphasized in comprehensive fracture risk assessment, underscoring the importance of preoperative evaluation and postoperative correction of metabolic deficiencies in patients with hip fractures.

Keywords: Bone metabolism markers; calcium; femoral neck fracture; hip fracture; intertrochanteric fracture; vitamin D.

INTRODUCTION

Hip fractures are becoming increasingly common due to extended life expectancy in the global population. Vitamin D deficiency is a well-recognized risk factor for hip fracture and

has been shown to predict functional recovery and survival following hip fracture surgery. Intertrochanteric and femoral neck fractures are associated with substantial morbidity, mortality, and economic burden. The rising prevalence of osteoporosis further escalates the risk of these fractures.^[1-3]

Cite this article as: Kemah B, Söylemez MS, Erinç S, Özkan K, Poyanlı OŞ. Comparison of vitamin D, parathyroid hormone (PTH), and bone metabolism markers in hip fracture patients by fracture type and control group. *Ulus Travma Acil Cerrahi Derg* 2026;32:367-373.

Address for correspondence: Bahattin Kemah

Department of Orthopaedics and Traumatology, Umraniye Training and Research Hospital, Istanbul, Türkiye

E-mail: bahattinkemah.md@gmail.com

Ulus Travma Acil Cerrahi Derg 2026;32(3):367-373 DOI: 10.14744/tjtes.2025.71736

Submitted: 02.09.2025 Revised: 25.10.2025 Accepted: 03.11.2025 Published: 10.03.2026

OPEN ACCESS This is an open access article under the CC BY-NC license (<http://creativecommons.org/licenses/by-nc/4.0/>).



Vitamin D is a fat-soluble steroid hormone that plays a pivotal role in calcium homeostasis and bone mineralization. Its deficiency has been linked to numerous systemic conditions, including osteoporosis and increased fracture risk. Elderly individuals are particularly susceptible because of reduced sun exposure and dietary insufficiencies. Although the role of vitamin D and calcium deficiencies in skeletal health is well established, their specific influence on different fracture types remains insufficiently explored.

Furthermore, studies examining the relationship between hip fracture classification and specific biochemical parameters, such as alkaline phosphatase (ALP), phosphorus, total protein, and albumin, are scarce.

The aim of our study was to investigate the association between hip fracture type and vitamin D levels, along with other biochemical parameters related to bone metabolism. By elucidating these relationships, this study seeks to provide insights that may contribute to preventive strategies for populations at increased risk.

MATERIALS AND METHODS

This retrospective study analyzed data from patients treated at a single tertiary care center over a five-year period, following approval from the institutional ethics board (ID: 2014/0180). The study was conducted in accordance with the principles of the Declaration of Helsinki. A total of 1,219 patients were identified through hospital registry screening, including 967 patients diagnosed with either femoral neck fracture or intertrochanteric femoral fracture, and 252 patients diagnosed with osteoarthritis (coxarthrosis or gonarthrosis). Demographic and clinical data were recorded at the time of diagnosis and included hip radiographs, comorbidities, regular medication use (osteoporosis treatment, calcium, and vitamin D supplementation), history of prior fractures, treatment modalities, laboratory test results (alkaline phosphatase, total protein, albumin, calcium, phosphorus, parathyroid hormone [PTH], and 25-hydroxyvitamin D [25-OH vitamin D]), and the city of residence during the year preceding the fracture.

The inclusion criteria encompassed individuals aged 65 years and older diagnosed with either an intertrochanteric femur fracture or a femoral neck fracture resulting from low-energy trauma, as well as patients with osteoarthritis who served as the control group.

Exclusion criteria included prior osteoporosis treatment or hormone therapy, high-energy trauma, malignancy, secondary osteoporosis, renal or gastrointestinal disorders, parathyroid or thyroid dysfunction, steroid use, and residence outside the study region for more than one year before enrollment. Ultimately, 375 cases were analyzed, including 117 patients with intertrochanteric fractures, 97 with femoral neck fractures, and 161 with osteoarthritis (coxarthrosis/gonarthrosis).

Demographic characteristics, fracture history, radiological

findings, comorbidities, and biochemical parameters (ALP, total protein, albumin, calcium, phosphorus, PTH, and 25-OH vitamin D) measured within the first week after fracture were obtained from hospital records. Although vitamin D levels are known to exhibit seasonal variation, all biochemical analyses were performed using the same chemiluminescence immunoassay method (Abbott Architect System®), ensuring standardization across samples. Seasonal variability was further minimized by collecting samples throughout all seasons. There is no globally defined threshold for optimal vitamin D levels, as these vary according to latitude, sun exposure, and race. In our study, threshold criteria for 25-OH vitamin D levels were determined based on the Diagnosis and Treatment Guidelines for Metabolic Bone Diseases published by the Turkish Society of Endocrinology and Metabolism. Accordingly, levels <10 ng/mL were classified as severe deficiency, 10-20 ng/mL as deficiency, 21-29 ng/mL as insufficiency, ≥30 ng/mL as sufficient, and >150 ng/mL as toxic.^[4]

Fractures were classified according to the AO/OTA (Arbeitsgemeinschaft für Osteosynthesefragen/Orthopaedic Trauma Association) system by two independent orthopedic surgeons who were blinded to the biochemical results.^[5] Any discrepancies were resolved by consensus under the supervision of the senior author.

Statistical Analysis

Statistical analyses were performed using NCSS (Number Cruncher Statistical System) 2007 and PASS (Power Analysis and Sample Size) 2008 software (Utah, USA). Inter-observer reliability was assessed using Cohen's kappa coefficient. Post hoc power analyses were conducted to evaluate the statistical power of the study and to reduce the risk of type II error. Descriptive statistics, including mean, standard deviation, median, frequency, and ratio, were used to summarize the data. For intergroup comparisons of normally distributed variables, one-way analysis of variance (ANOVA) was applied, followed by the Tukey Honestly Significant Difference (HSD) test to identify the source of significant differences. Non-normally distributed variables were analyzed using the Kruskal-Wallis test for overall group comparisons, followed by the Mann-Whitney U test to identify differences between pairs of groups. Relationships between variables were assessed using Spearman's correlation analysis. Results were evaluated at a 95% confidence interval, and statistical significance was set at $p < 0.05$.

RESULTS

A total of 375 patients were included in the study, with ages ranging from 65 to 93 years (mean, 78.34 ± 6.42 years). Of these, 292 patients (77.9%) were female and 83 (22.1%) were male. The intertrochanteric femur fracture (ITFF) group included 117 patients, the femoral neck fracture (FNF) group included 97 patients, and the control group (patients with coxarthrosis or gonarthrosis) included 161 patients.

Post hoc power analysis demonstrated power values ranging

Table 1. Age and sex distribution of the study groups

	ITFF (n=117)	Femoral Neck Fracture (n=97)	Control (n=161)	P
Age				
Mean±SD (range)	79.59±6.16 (65-93)	78.31±7.26 (65-90)	77.12±5.84 (65-92)	^a 0.056
Sex				
Female, n (%)	91 (77.8)	75 (77.3)	126 (78.4)	^b 0.988
Male, n (%)	26 (22.2)	22 (22.7)	35 (21.7)	

ITFF: Intertrochanteric femur fracture; ^aOne-way analysis of variance (ANOVA) test; ^bChi-square test.

from 0.984 to 1.000 for the primary qualitative outcomes, indicating a minimal risk of type II error and confirming that the sample size was sufficient. Inter-observer reliability for fracture classification was excellent ($\kappa=0.89$). No statistically significant differences were observed among the groups with respect to age ($p=0.056$) or sex distribution ($p=0.988$) (Table 1).

According to the AO/OTA classification, 38 patients (32.9%) in the intertrochanteric femur fracture group were classified as A1, 59 patients (50.4%) as A2, and 20 patients (17.1%) as A3. In the femoral neck fracture group, six patients (6.3%)

were classified as B1, 51 patients (53.7%) as B2, and 38 patients (40%) as B3.

25-OH vitamin D levels were significantly lower in both the ITFF and FNF groups compared to the control group ($p<0.01$). However, no significant difference was observed between the ITFF and FNF groups ($p>0.05$). Mean vitamin D levels were 12.28 ± 8.61 ng/mL in the ITFF group and 16.1 ± 13.12 ng/mL in the FNF group. Vitamin D deficiency was prevalent across all groups (Table 2, Fig. 1).

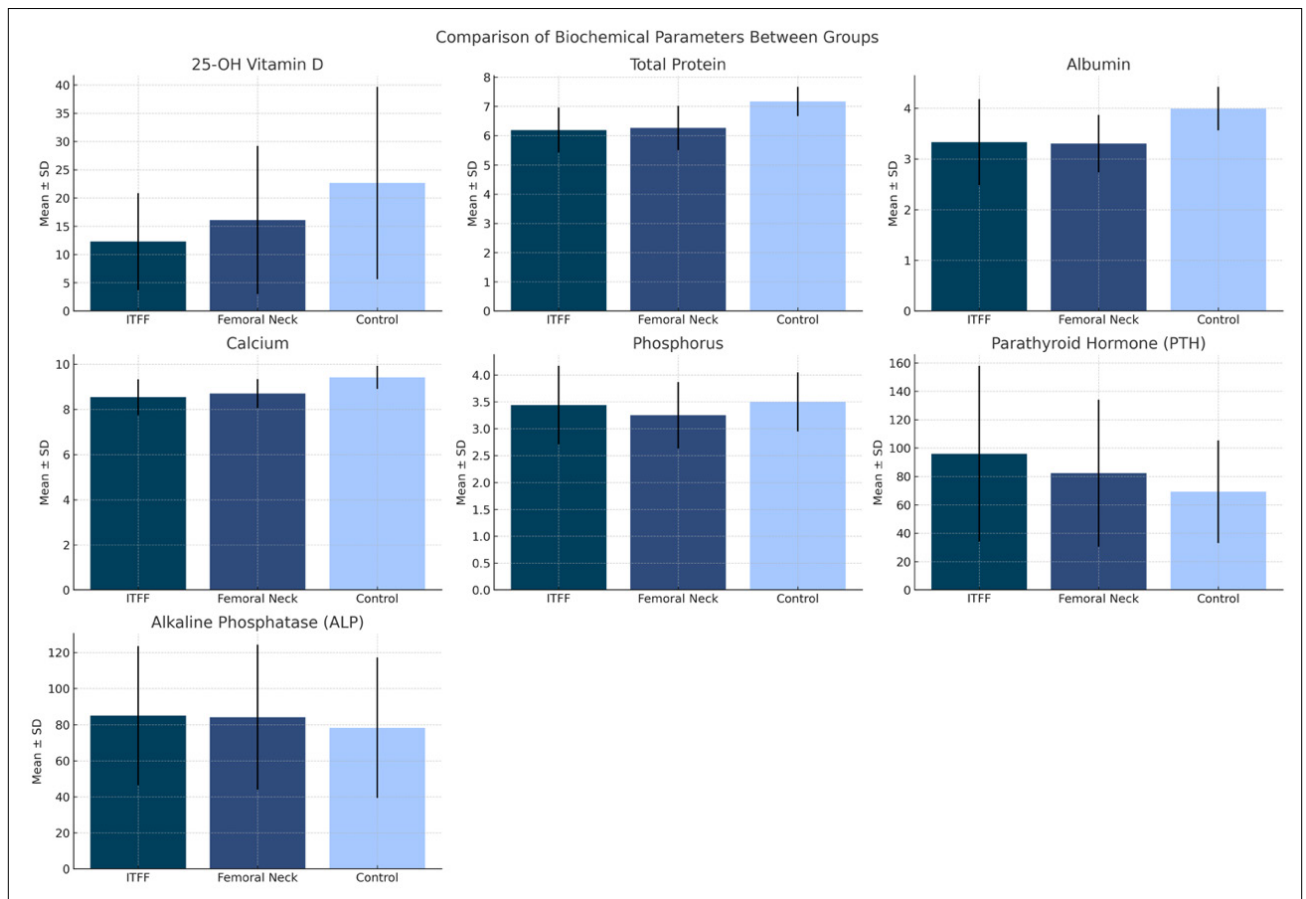


Figure 1. Group-wise mean (\pm standard deviation) levels of 25(OH) vitamin D, total protein, albumin, calcium, phosphorus, parathyroid hormone (PTH), and alkaline phosphatase (ALP) in the intertrochanteric femur fracture (ITFF), femoral neck fracture (FNF), and control groups.

Table 2. Comparison of 25-OH vitamin D, total protein, albumin, calcium, phosphorus, parathyroid hormone (PTH), and alkaline phosphatase (ALP) levels among fracture groups and controls

	¹ ITFF	² Femoral Neck Fracture	³ Control	^a p	^b Post Hoc
25-OH Vitamin D					
Mean±SD	12.28±8.61	16.10±13.12	22.65±17.00	0.001**	P¹⁻² 0.059
Min-Max (median)	3-51.2 (10.50)	1.90-68 (12.10)	5.20-133 (19.80)		P¹⁻³ 0.001**
Severe deficiency, n (%)	53 (45.3)	41 (42.3)	20 (12.4)		P²⁻³ 0.001**
Deficiency, n (%)	49 (41.9)	33 (34.0)	69 (42.9)		
Insufficiency, n (%)	10 (8.5)	11 (11.3)	45 (28.0)		
Sufficiency, n (%)	5 (4.3)	12 (12.4)	25 (15.5)		
Toxic level, n (%)	0	0	0		
Total Protein					
Mean±SD	6.19±0.77	6.26±0.76	7.17±0.50	0.001**	P¹⁻² 1.000
Min-Max (median)	3.96-9.70 (6.20)	4.47-8.97 (6.20)	5.00-8.50 (7.15)		P¹⁻³ 0.001**
Abnormal, n (%)	71 (60.7)	58 (59.8)	8 (5.0)		P²⁻³ 0.001**
Normal, n (%)	46 (39.3)	39 (40.2)	153 (95.0)		
Albumin					
Mean±SD	3.33±0.85	3.30±0.57	3.99±0.43	0.001**	P¹⁻² 0.952
Min-Max (median)	1.90-9.00 (3.30)	1.90-4.70 (3.40)	2.40-5.00 (4.00)		P¹⁻³ 0.001**
Abnormal, n (%)	78 (66.7)	60 (61.9)	17 (10.6)		P²⁻³ 0.001**
Normal, n (%)	39 (33.3)	39 (38.1)	144 (89.4)		
Calcium					
Mean±SD	8.54±0.80	8.70±0.65	9.42±0.51	0.001**	P ¹⁻² 0.169
Min-Max (median)	4.10-11.90 (8.50)	6.66-10.40 (8.70)	7.50-10.70 (9.50)		P ¹⁻³ 0.001**
Abnormal, n (%)	64 (54.7)	42 (43.3)	9 (5.6)		P ²⁻³ 0.001**
Normal, n (%)	53 (45.3)	55 (56.7)	152 (94.4)		
Phosphorus					
Mean±SD	3.44±0.73	3.25±0.62	3.50±0.55	0.006**	P¹⁻² 0.074
Min-Max (median)	1.10-5.50 (3.40)	1.80-4.50 (3.28)	2.00-5.30 (3.50)		P¹⁻³ 0.764
Abnormal, n (%)	11 (9.4)	6 (6.4)	4 (2.5)		P²⁻³ 0.008**
Normal, n (%)	106 (90.6)	91 (93.8)	157 (97.5)		
PTH					
Mean±SD	95.97±61.95	82.26±51.87	69.23±36.16	0.004**	P¹⁻² 0.142
Min-Max (median)	13.30-250.0 (77.10)	21.80-263.0 (65)	16.00-250.0 (65.1)		P¹⁻³ 0.001**
Abnormal, n (%)	52 (44.4)	30 (30.9)	30 (18.6)		P²⁻³ 0.113
Normal, n (%)	65 (55.6)	67 (69.1)	131 (81.4)		
ALP					
Mean±SD	84.98±38.57	84.12±40.19	78.31±38.98	0.127	P¹⁻² 0.394
Min-Max (median)	36.00-290.00 (79.00)	37.00-306.00 (75.00)	27.00-480.00 (75)		P¹⁻³ 0.065
Abnormal, n (%)	11 (9.4)	8 (8.2)	7 (4.3)		P²⁻³ 0.360
Normal, n (%)	106 (90.6)	89 (91.8)	154 (95.7)		

**Statistically significant; ^aANOVA; ^bPost hoc pairwise comparisons.

Total protein and albumin levels were significantly lower in both fracture groups compared to the control group (p=0.001), while no difference was observed between the

ITFF and FNF groups. Serum calcium levels were also lower in fracture patients (mean, 8.1±0.5 mg/dL; p<0.01). PTH levels were significantly higher in both fracture groups compared

to controls ($p=0.001$), with abnormal PTH rates of 44.4%, 30.9%, and 18.6% in the ITFF, FNF, and control groups, respectively. As expected, ALP and phosphorus levels did not differ significantly among the groups (Table 2).

DISCUSSION

The primary findings of this study indicate that lower serum calcium and 25(OH) vitamin D levels are associated with an increased risk of hip fractures but do not influence fracture type. These results are consistent with previous reports identifying vitamin D and calcium deficiency as major risk factors for hip fractures.^[6-11] The low 25(OH) vitamin D levels observed across all groups, including the control group, are in agreement with prior studies and may reflect insufficient sunlight exposure, reduced outdoor activity, and diminished dermal vitamin D synthesis in elderly individuals.^[12] Approximately 85% of vitamin D is synthesized through ultraviolet exposure, with the remainder obtained from dietary sources.^[2]

Vitamin D deficiency contributes to secondary hyperparathyroidism, increased bone turnover, and skeletal fragility. Although no difference in 25(OH) vitamin D levels was observed between intertrochanteric femur fracture and femoral neck fracture groups, both fracture groups exhibited significantly lower levels than the control group. Similar to previous studies, our findings indicate that vitamin D deficiency is associated with fracture occurrence rather than fracture subtype. In contrast, several small-sample studies have proposed a relationship between vitamin D levels and fracture severity.^[13,14] Differences between FNF and ITFF may be attributable to variations in trabecular bone composition and metabolic activity, as the intertrochanteric region contains a higher proportion of metabolically active trabecular bone.^[15,16] Nevertheless, fracture configuration appears to be primarily determined by mechanical and anatomical factors rather than biochemical variables.

Geographical variation in fracture patterns has been previously reported, with trochanteric fractures occurring more frequently in Southern Europe and femoral neck fractures predominating in Northern Europe.^[17-19] Our findings are consistent with data from Japan (FNF/ITFF ratio of 1:1.3) and other Mediterranean populations, which demonstrate a higher incidence of intertrochanteric fractures.^[20]

Protein and albumin levels were significantly lower in patients with hip fractures compared to controls, consistent with previous studies.^[20,21] Whether these findings represent pre-existing risk factors or reflect a post-fracture catabolic response remains unclear. Nevertheless, several studies have identified low protein and albumin levels as independent predictors of fracture risk.^[22] Similarly, calcium levels were reduced in both fracture groups, likely secondary to vitamin D deficiency.^[21] Randomized controlled trials have demonstrated that adequate dietary calcium and protein intake can reduce the risk of hip fractures.^[23]

Parathyroid hormone levels were significantly elevated in the fracture groups, particularly among patients with ITFF, in line with earlier reports.^[20,24,25] This elevation most likely represents a compensatory response to vitamin D deficiency rather than a direct effect of the fracture itself. Phosphorus levels were slightly lower in the FNF group but not in the ITFF group, similar to previous findings indicating minimal differences among fracture types.^[17] Although elevated alkaline phosphatase levels have been proposed as a potential risk factor for fractures, no significant association was observed in our study.^[26]

Several limitations of this study should be acknowledged. The retrospective, single-center design may limit the generalizability of the results, and potential confounding factors, such as lifestyle habits and nutritional intake, could not be fully controlled. In addition, serum vitamin D levels were measured at a single time point, without accounting for seasonal variation that may influence vitamin D status. The lack of longitudinal follow-up data precluded assessment of postoperative changes or the long-term effects of vitamin D and calcium optimization on bone healing and functional recovery. Future prospective, multicenter studies incorporating serial biochemical measurements are needed to validate these findings and to further elucidate the causal relationships between metabolic parameters and fracture risk.

From a clinical perspective, these findings underscore that optimal management of hip fractures should extend beyond surgical fixation to include the identification and correction of underlying metabolic abnormalities. Comprehensive pre-operative evaluation and timely optimization of vitamin D and calcium levels may enhance bone quality, promote fracture healing, and reduce postoperative complications. Therefore, routine assessment and management of these biochemical parameters should be incorporated into standard protocols for hip fracture care to ensure a more holistic and effective treatment approach.

CONCLUSION

This study demonstrated a significant deterioration in biochemical markers among individuals with hip fractures. Vitamin D deficiency was prevalent across all groups, with particularly severe deficiency observed in patients with intertrochanteric and femoral neck fractures. The absence of significant differences in biochemical parameters among AO subtypes indicates that, while these markers contribute to overall fracture risk, they do not appear to influence fracture pattern.

Ethics Committee Approval: This study was approved by the İstanbul Medeniyet University Göztepe Training and Research Hospital Clinical Research Ethics Committee (Date: 16.12.2014, Decision No: 2014/0180).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: B.K.; Design: BK,

O.Ş.P.; Supervision: B.K., K.Ö.; Resource: B.K.; Materials: O.Ş.P., K.Ö.; Data collection and/or processing: B.K., S.E.; Analysis and/or interpretation: B.K., M.S.S.; Literature review: B.K.; Writing: B.K.; Critical review: B.K., M.S.S., K.Ö., O.Ş.P.

Conflict of Interest: None declared.

Financial Disclosure: The author declared that this study has received no financial support.

REFERENCES

- Johal KS, Boulton C, Moran CG. Hip fractures after falls in hospital: a retrospective observational cohort study. *Injury* 2009;40:201–4. [\[CrossRef\]](#)
- Lips P, van Ginkel FC, Jongen MJ, Rubertus F, van der Vijgh WJ, Ne-telenbos JC. Determinants of vitamin D status in patients with hip fracture and in elderly control subjects. *Am J Clin Nutr* 1987;46:1005–10. [\[CrossRef\]](#)
- Altınsoy KE, Unat B. The role of bone turnover markers in diagnosis, monitoring, and pathological fractures of osteoporosis. *Ulus Travma Acil Cerrahi Derg* 2024;30:323–7. [\[CrossRef\]](#)
- Tuzun S, Eskiyurt N, Akarirmak U, Saridogan M, Senocak M, Johanson H, et al; Turkish Osteoporosis Society. Incidence of hip fracture and prevalence of osteoporosis in Turkey: the FRACTURK study. *Osteoporos Int* 2012;23:949–55. [\[CrossRef\]](#)
- Meinberg EG, Agel J, Roberts CS, Karam MD, Kellam JF. Fracture and dislocation classification compendium-2018. *J Orthop Trauma* 2018;32 Suppl 1:S1-S170. [\[CrossRef\]](#)
- Lips P. Vitamin D deficiency and secondary hyperparathyroidism in the elderly: consequences for bone loss and fractures and therapeutic implications. *Endocr Rev* 2001;22:477–501. [\[CrossRef\]](#)
- Habibi Ghahfarrokhi S, Mohammadian-Hafshejani A, Sherwin CMT, Heidari-Soureshjani S. Relationship between serum vitamin D and hip fracture in the elderly: a systematic review and meta-analysis. *J Bone Miner Metab* 2022;40:541–53. [\[CrossRef\]](#)
- Wang N, Chen Y, Ji J, Chang J, Yu S, Yu B. The relationship between serum vitamin D and fracture risk in the elderly: a meta-analysis. *J Orthop Surg Res* 2020;15:81. [\[CrossRef\]](#)
- Cianferotti L, Bifulco G, Caffarelli C, Mazziotti G, Migliaccio S, Napoli N, et al. Nutrition, Vitamin D, and Calcium in elderly patients before and after a hip fracture and their impact on the musculoskeletal system: a narrative review. *Nutrients* 2024;16:1773. [\[CrossRef\]](#)
- Feng Y, Cheng G, Wang H, Chen B. The associations between serum 25-hydroxyvitamin D level and the risk of total fracture and hip fracture. *Osteoporos Int* 2017;28:1641–52. [\[CrossRef\]](#)
- Cong B, Zhang H. The effects of combined calcium and vitamin D supplementation on bone mineral density and fracture risk in postmenopausal women with osteoporosis: a systematic review and meta-analysis of randomized controlled trials. *BMC Musculoskelet Disord* 2025;26:928. [\[CrossRef\]](#)
- Bakhtiyarova S, Lesnyak O, Kyznesova N, Blankenstein MA, Lips P. Vitamin D status among patients with hip fracture and elderly control subjects in Yekaterinburg, Russia. *Osteoporos Int* 2006;17:441–6. [\[CrossRef\]](#)
- Zhao J, Cai Q, Jiang D, Wang L, Chen S, Jia W. The associations of serum vitamin d and bone turnover markers with the type and severity of hip fractures in older women. *Clin Interv Aging* 2020;15:1971–8. [\[CrossRef\]](#)
- Jamal AB, Hasan Khan MN, Sadiq M. Intertrochanteric hip fractures and vitamin D deficiency; a significant association. *J Ayub Med Coll Abbottabad* 2021;33(2):257–61.
- Gerdhem P, Ivaska KK, Alatalo SL, Halleen JM, Hellman J, Isaksson A, et al. Biochemical markers of bone metabolism and prediction of fracture in elderly women. *J Bone Miner Res* 2004;19:386–93. [\[CrossRef\]](#)
- Polat G, Bayram S, Gökçeoğlu YS, Albayrak O, Kahraman A, Durmaz H. The Effect of bone morphology on fracture type and treatment result in patients with intertrochanteric femur fracture aged over 65 year. *Ulus Travma Acil Cerrahi Derg* 2022;28:1731–8. [\[CrossRef\]](#)
- Dretakis OE, Margioris AN, Tsatsanis C, Dretakis KE, Malliaraki N, Steriopoulos K. Elderly patients with trochanteric hip fracture have lower serum Vitamin D levels compared to patients with cervical hip fracture. *Arch Gerontol Geriatr* 2011;52:e15–8. [\[CrossRef\]](#)
- van der Wielen RP, Löwik MR, van den Berg H, de Groot LC, Haller J, Moreiras O, et al. Serum vitamin D concentrations among elderly people in Europe. *Lancet* 1995;346:207–10. [\[CrossRef\]](#)
- Lizaur-Utrilla A, Puchades Orts A, Sanchez del Campo F, Anta Barrio J, Gutierrez Carbonell P. Epidemiology of trochanteric fractures of the femur in Alicante, Spain, 1974-1982. *Clin Orthop Relat Res* 1987;24–31. [\[CrossRef\]](#)
- Sakuma M, Endo N, Oinuma T, Hayami T, Endo E, Yazawa T, et al. Vitamin D and intact PTH status in patients with hip fracture. *Osteoporos Int* 2006;17:1608–14. [\[CrossRef\]](#)
- LeBoff MS, Kohlmeier L, Hurwitz S, Franklin J, Wright J, Glowacki J. Occult vitamin D deficiency in postmenopausal US women with acute hip fracture. *JAMA* 1999;281:1505–11. [\[CrossRef\]](#)
- Thiébaud D, Burckhardt P, Costanza M, Sloutskis D, Gilliard D, Quinodoz F, et al. Importance of albumin, 25(OH)-vitamin D and IGFBP-3 as risk factors in elderly women and men with hip fracture. *Osteoporos Int* 1997;7:457–62. [\[CrossRef\]](#)
- Iuliano S, Poon S, Robbins J, Bui M, Wang X, De Groot L, et al. Effect of dietary sources of calcium and protein on hip fractures and falls in older adults in residential care: cluster randomised controlled trial. *BMJ* 2021;375:n2364. [\[CrossRef\]](#)
- Lips P, Duong T, Oleksik A, Black D, Cummings S, Cox D, et al. A global study of vitamin D status and parathyroid function in postmenopausal women with osteoporosis: baseline data from the multiple outcomes of raloxifene evaluation clinical trial. *J Clin Endocrinol Metab* 2001;86:1212–21. [\[CrossRef\]](#)
- Thomas MK, Lloyd-Jones DM, Thadhani RI, Shaw AC, Deraska DJ, Kitch BT, et al. Hypovitaminosis D in medical inpatients. *N Engl J Med* 1998;338:777–83. [\[CrossRef\]](#)
- Garnero P, Sornay-Rendu E, Chapuy MC, Delmas PD. Increased bone turnover in late postmenopausal women is a major determinant of osteoporosis. *J Bone Miner Res* 1996;11:337–49. [\[CrossRef\]](#)

ORİJİNAL ÇALIŞMA - ÖZ

Kalça kırıklı hastalarda kırık tipine ve kontrol grubuna göre D vitamini, PTH ve kemik metabolizması belirteçlerinin karşılaştırılması

AMAÇ: D vitamini, kalsiyum ve kemik metabolizması belirteçleri iskelet sağlığında kritik bir rol oynamaktadır; ancak bu parametrelerin farklı kalça kırığı tipleriyle ilişkisi net değildir. Bu çalışmada, femur boyun kırığı (FBK) ve intertrokanterik femur kırığı (İTFK) olan yaşlı hastalarda serum 25(OH) D vitamini, kalsiyum, paratiroid hormon (PTH), alkalen fosfataz (ALP), fosfor, total protein ve albümin düzeylerinin kontrol grubu ile karşılaştırılması amaçlanmıştır.

GEREÇ VE YÖNTEM: Bu retrospektif çalışmaya 65 yaş ve üzerindeki toplam 375 hasta dahil edilmiştir; bunların 117'si intertrokanterik femur kırığı (İTFK), 97'si femur boyun kırığı (FBK) ve 161'i kontrol grubunu (koksartroz/gonartroz) oluşturmaktadır. Serum biyokimyasal parametreleri standart laboratuvar yöntemleri ile analiz edilmiştir. Kırıklar, iki bağımsız gözlemci tarafından AO/OTA sınıflamasına göre değerlendirilmiş ve gözlemciler arası uyum değerlendirilmiştir. Gözlemciler arası uyum Cohen's kappa katsayısı ile analiz edildi ($\kappa=0.89$). Gruplar arasındaki karşılaştırmalarda tek yönlü ANOVA ve post hoc Bonferroni testleri kullanılmıştır. İstatistiksel anlamlılık düzeyi $p<0.05$ olarak kabul edilmiştir.

BULGULAR: D vitamini düzeyleri hem İTFK hem de FBK gruplarında kontrol grubuna göre anlamlı olarak düşük bulunmuştur ($p<0.01$), ancak İTFK ve FBK grupları arasında anlamlı bir fark saptanmamıştır ($p>0.05$). Benzer şekilde, kalsiyum, total protein, ve albümin düzeyleri kırık gruplarında kontrollerden daha düşük bulunurken ($p<0.01$), PTH düzeyleri kırık hastalarında anlamlı derecede yüksek saptanmıştır ($p=0.001$).

SONUÇ: D vitamini ve kalsiyum eksikliklerinin kalça kırığı riskini artırdığı, ancak kırık paternini belirlemediği görülmüştür. Bu bulgular, kalça kırığı hastalarında metabolik eksikliklerin ameliyat öncesi değerlendirilmesi ve ameliyat sonrası düzeltilmesinin önemini vurgulayarak, sistemik biyokimyasal parametrelerin kapsamlı kırık riski değerlendirmesinde vurgulanması gerektiğini düşündürmektedir.

Anahtar sözcükler: D vitamini; femur boyun kırığı; intertrokanterik kırık; kalsiyum; kalça kırığı; kemik metabolizması belirteçleri.

Ulus Travma Acil Cerrahi Derg 2026;32(3):367-373 DOI: 10.14744/tjtes.2025.71736