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Original Article

Association of hip osteoporosis with pattern of proximal femoral fractures

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Abstract

Introduction: Proximal femoral fractures account for a large number of hospitalization cases among the elderly patients. The proximal femoral fractures pattern based on intra-articular or extra-articular could affect the treatment options and induce several complications. The aim of this study is to evaluate the relationship between the severity of osteoporosis and pattern of proximal femoral fractures among elderly patients.

Methods: In this cross-sectional study, 83 patients over than 65 years old were enrolled from 2014 to 2018 in the orthopedic department of Urmia University of Medical Sciences, Urmia, Iran. Bone mineral density (BMD) was determined by dual energy x-ray absorptiometry (DXA) at the time of hospitalization. Vitamin D level was also measured. Finally, the mortality rate was determined in 12-month follow-up after the operation.

Results: In this study, 83 patients with proximal femoral fractures including 60 cases (72.3%) with extra-articular fractures and 23 cases (27.7%) with intra-articular fractures were investigated. The mean vitamin D level of these two groups [patients with intra-articular fracture (34.4 ± 24.7 nmol/l) and extra-articular fracture (11.3 ± 5.4 nmol/l)] was significantly different ($P = 0.020$). A significant difference was also observed in the bone densities (based on T-score) of these two groups ($P < 0.001$). The patients' mortality rate was significantly different and it was higher in patients with extra-articular fracture (23.0%) compared to those with intra-articular fracture (17.3%) ($P = 0.020$).

Conclusion: In the case of elderly patients, the hip bone density and vitamin D levels play a decisive role in predicting the pattern of proximal femoral fractures. It was also associated with increased mortality among the elderly patients.

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Introduction

Among the older population of over 65 years old, the hip fractures still represent one of the most important causes of morbidity and mortality.[1] Insufficiency fractures usually occur in hip, distal radius, and lumbar spinal vertebral in elderly patients.[1,2] The proximal femoral part, especially the intertrochanteric region, tolerates high rates of stress as it is exposed to continuous severe physical stresses.[3] In 1990s, about 26% of the total hip fractures occurred in Asia and it is estimated to reach 37% in 2025 and 45% by 2050.[3,4] On the other hand, with improved life expectancy, the statistics of these fractures will increase in the future, estimated to be doubled by 2040.[4] These fractures will result in high rates of complications, and its post-surgery mortality rate is reported to vary between 15% and 30%.[4] Intertrochanteric fracture is associated with osteoporosis.[1,4] The treatment option of proximal femoral fractures depends on its pattern (intra-articular or extra-articular) and it can induce several complications. The aim of this study was to evaluate the relationship between the severity

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of osteoporosis and the pattern of proximal femoral fractures among the elderly patients.

Methods

This cross-sectional study was conducted from 2014 to 2018 in the orthopedic department of Urmia University of Medical Sciences, Urmia, Iran, in which 83 patients, over than 65 years old, were enrolled. All of these patients suffered from proximal femoral fractures due to low-energy trauma and insufficiency fracture. Patients with high-energy trauma (car accident or falling down from heights over 2m), pathologic fracture, and history of deformity or previous fractures in lower limb were excluded. In all the mentioned patients, serum 25-hydroxyvitamin D [25(OH)D] was measured using Nichols Advantage 25(OH)D chemiluminescent assay (Nichols Institute Diagnostics, San Clemente, CA). Normal range of serum vitamin D [25(OH)D] was 23-113 nmol/l. Bone mineral density (BMD) was determined by dual-energy x-ray absorptiometry (DXA) at the time of hospitalization. The severity of osteoporosis was determined according to the T-score. A T-score varying between +1 and −1 was considered normal or healthy; while T-score values between -1 and -2.5 indicated low bone mass (osteopenia). T-scores equal or below -2.5 were regarded as the indicator of osteoporosis. The fracture pattern (intra-articular or extra-articular) was determined based on primary conventional radiography. Finally, the patients' mortality rate was recorded in a 12-month follow-up.

Statistical analyses were carried out using SPSS software (version 16, SPSS Inc., Chicago, IL, USA). Continuous variables were reported as mean ± standard deviation (SD). Normality of the distributions was checked for each variable using the Kolmogorov-Smirnov test. Chi-square statistical tests were employed to study the qualitative variables. Nonparametric tests (Mann-Whitney U) were also used to compare the two groups in which the significance level was set at $P \leq 0.050$.

Results

In this study, 83 patients with proximal femoral fractures including 60 cases (72.3%) with extra-articular fractures and 23 cases (27.7%) with intra-articular fractures were addressed. Demographic findings are reported in table 1. Mean vitamin D level of these two groups was significantly different ($P = 0.020$), where patients with intra-articular fracture had higher levels of vitamin D compared with the patients with extra-articular fracture (34.4 ± 24.7 nmol/l vs. 11.3 ± 5.4 nmol/l) (Figure 1). A significant difference was also detected in the bone density of these groups based on their T-scores ($P < 0.001$).

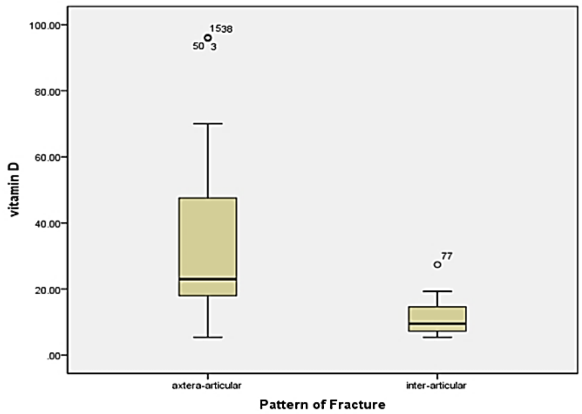

Figure 1. Comparison of vitamin D level between the two groups of intra-articular and extra-articular fractures in elderly patients

Table 1. Comparison of demographic findings between the two groups

Variable	Extra-articular fractures (n = 60)	Intra-articular fractures (n = 23)
Age (year) (mean ± SD)	75.1 ± 8.7	74.6 ± 10.0
Sex [n (%)]		
Male	37 (61.7)	6 (26.1)
Female	23 (38.3)	17 (73.9)
BMI (kg/m^2) (mean ± SD)	25.2 ± 2.1	25.7 ± 1.3
Mortality rate [n (%)]	14 (23.0)	4 (17.3)

BMI: Body mass index; SD: Standard deviation

The mean bone density of the patients with intra-articular fracture was -2.2 ± 0.9 SD which was significantly higher than that of the patients with extra-articular fracture (-3.1 ± 1.8) (P = 0.004) (Figure 2). Patients' mortality rate was significantly different, as it was higher in patients with extra-articular fracture compared to those with intra-articular fracture (P = 0.020).

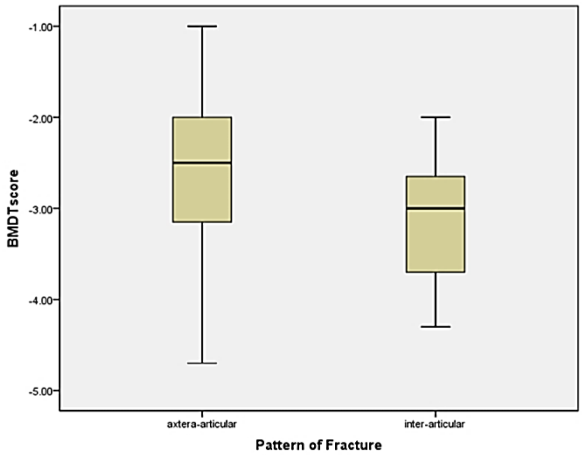

Figure 2. Comparison of bone mineral density (BMD) based on T-score between the two groups of intra-articular and extra-articular fractures in elderly patients

Discussion

Proximal femoral fracture is one of the most common causes of hospitalization in the elderlies.[5] With increase of the life expectancy and growth of population, a significant increase in the prevalence of these fractures is expected in the next 20 or 30 years.[1,4] The proximal femoral fractures in the elderlies sometimes occur due to ineffective or suboptimal protective responses, cognitive impairment, and fear of falling.[6] Physically inactive patients are twice at the risk of fracture compared to the active adults.[7]

Hip fracture rate in the developing countries has increased compared to the developed countries due to the negative impact on bone health, muscle physiology, muscle mass, overall health status, and inadequate vitamin D in physically inactive elderly patients.[6,7] In the present study, there was a significant difference in vitamin D levels of the two groups (extra- and intra-articular fracture), where the average of vitamin D in the patients with extra-articular and intra-articular fractures was 34.4 nmol/l and 11.3 nmol/l, respectively. Thus, the patients with extra-articular fractures had lower vitamin D levels. A significant difference was also observed between the two groups in terms of bone density based on T-score. The mean bone density of the patients with extra-articular fracture was much lower than the patients with intra-articular hip fracture, which was in line with findings observed by Nakamura et al.[8] and Spencer et al.[9] who found that patients with extra-capsular fractures had statistically significant lower BMD compared to those with intra-capsular fractures. The authors stated that the intertrochanteric region had 80% to 90% of the cancellous bones; therefore, higher levels of osteoporosis were estimated because of the secondary imbalance in the bone mineralization in elderly patients.[8,9] Fox et al. reported an unexpected association between the oral intakes of calcium supplements with intertrochanteric fracture.[10] The same hypothesis was explained for the patients with a history of fracture, since patients with multiple fractures have lower BMD.[11] Moreover, Blain et al. assessed cortical porosity in osteoporotic and osteoarthritis of hip, suggesting that in osteoporosis, fragility fractures could result from both the cortical thinning and the trabecular bone rarefaction associated with loss of trabecular connectivity.[12] Furthermore, according to our findings, patients with lower bone density and low levels of vitamin D are at higher risk of mortality.

Conclusion

The hip bone density and vitamin D levels play an important role in predicting the pattern of proximal femoral fractures. Inappropriate values of these two parameters are also associated with increased mortality among elderly patients.

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Authors' Contribution

All of the authors contributed equally.

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Conflict of Interest

Authors have no conflict of interest.

Ethical Approval

This study was confirmed by Ethics Committee of Urmia University of Medical Sciences (1396-09-32-3171).

References

1. Roder F, Schwab M, Aleker T, Morike K, Thon KP, Klotz U. Proximal femur fracture in older patients--rehabilitation and clinical outcome. Age Ageing 2003; 32(1): 74-80. DOI: 10.1093/ageing/32.1.74
2. Kirke PN, Sutton M, Burke H, Daly L. Outcome of hip fracture in older Irish women: A 2-year follow-up of subjects in a case-control study. Injury 2002; 33(5): 387-91. DOI: 10.1016/S0020-1383(02)00025-6
3. Parker MJ, Pryor GA. The timing of surgery for proximal femoral fractures. J Bone Joint Surg Br 1992; 74(2): 203-5.
4. Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. Lancet 2002; 359(9319): 1761-7. DOI: 10.1016/S0140-6736(02)08657-9
5. Yoon BH, Lee YK, Kim SC, Kim SH, Ha YC, Koo KH. Epidemiology of proximal femoral fractures in South Korea. Arch Osteoporos 2013; 8: 157. DOI: 10.1007/s11657-013-0157-9
6. Rahman O. Pattern of femoral fractures. Journal of Rawalpindi Medical College 2013; 17(1): 42-4.
7. Lyritis GP, the MEDOS Study Group. Epidemiology of hip fracture: The MEDOS study. Osteoporosis International 1996; 6(3): 11-5. DOI: 10.1007/BF01623757
8. Nakamura N, Kyou T, Takaoka K, Ohzono K, Ono K. Bone mineral density in the proximal femur and hip fracture type in the elderly. J Bone Miner Res 1992; 7(7): 755-9. DOI: 10.1002/jbmr.5650070705
9. Spencer SJ, Blyth MJ, Lovell F, Holt G. Does bone mineral density affect hip fracture severity? Orthopedics 2012; 35(6): e945-e949. DOI: 10.3928/01477447-20120525-34
10. Fox KM, Magaziner J, Hebel JR, Kenzora JE, Kashner TM. Intertrochanteric versus femoral neck hip fractures: Differential characteristics, treatment, and sequelae. J Gerontol A Biol Sci Med Sci 1999; 54(12): M635-M640. DOI: 10.1093/gerona/54.12.M635
11. Hey HW, Sng WJ, Lim JL, Tan CS, Gan AT, Ng JH, et al. Interpretation of hip fracture patterns using areal bone mineral density in the proximal femur. Arch Orthop Trauma Surg 2015; 135(12): 1647-53. DOI: 10.1007/s00402-015-2326-3
12. Blain H, Chavassieux P, Portero-Muzy N, Bonnel F, Canovas F, Chammas M, et al. Cortical and trabecular bone distribution in the femoral neck in osteoporosis and osteoarthritis. Bone 2008; 43(5): 862-8. DOI: 10.1016/j.bone.2008.07.236