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RESEARCH

DEGREE OF OSTEOPOROSIS AFFECTS THE FRACTURE SITE IN OLDER PATIENTS WITH PROXIMAL FEMUR FRACTURES

ABSTRACT

Introduction: This study was performed to analyse the relationship between the existence and degree of osteoporosis with age, gender, fracture site and laterality in older patients having proximal fractures due to simple fall.

Materials and Method: Records of 200 consecutive patients ((117 women, 83 men, mean age 74.5 years) who were at or older than 60 years of age and had proximal femoral fracture were retrospectively analyzed.

Results: A significant difference was not found between the osteoporotic and non-osteoporotic groups with respect to age, gender, laterality and fracture site ($p>0.05$). The rate of intertrochanteric fracture was significantly higher in borderline/mild osteoporosis group than the rate in moderate/severe osteoporosis group ($p<0.001$). The grade of osteoporosis was not related to age, gender and laterality in the osteoporotic patients with proximal femur fractures ($p>0.05$).

Conclusion: Older patients with borderline or mild osteoporosis are more prone to intertrochanteric fractures in the hip region. The risk of femoral neck fractures increases in patients with advanced osteoporosis.

Key Words: Aged; Hip Fractures; Osteoporosis.

ARAŞTIRMA

PROKSİMAL FEMUR KIRIĞI BULUNAN YAŞLI HASTALARDA OSTEOPOROZ DERECESİ KIRIĞIN YERİNİ ETKİLER

ÖZ

Giriş: Bu çalışma basit düşmeye bağlı proksimal femur kırığı bulunan yaşlı hastalarda osteoporoz varlığı ve derecesi ile yaş, cinsiyet, kırık yeri ve tarafı arasındaki ilişkiyi açıklayabilmek için yapıldı.

Gereç ve Yöntem: 60 yaş ya da daha yaşlı olan proksimal femur kırığı bulunan 200 hasta dosyası geriye yönelik olarak incelendi.

Bulgular: Osteoporoz bulunan ve bulunmayan gruplar arasında yaş, cinsiyet, kırık yeri ve tarafı açısından anlamlı fark saptanmadı ($p>0.05$). İntertrokanterik kırık oranı sınırda ya da hafif osteoporozu bulunan hastalarda orta ya da şiddetli osteoporozu bulunan hastalara göre belirgin fazlaydı ($p<0.001$). Proksimal femur kırığı bulunan osteoporotik hastalarda osteoporoz derecesi yaş, cinsiyet ve kırık taraf ile ilişkili değildi ($p>0.05$).

Sonuç: Sonuç olarak sınırda ya da hafif osteoporozu bulunan hastalarda intertrokanterik kırıklar daha fazla görülürken, femur boyun kırığı oluşma riski şiddetli osteoporozu olan hastalarda artmaktadır

Anahtar Sözcükler: Yaşlı; Kalça Kırığı; Osteoporoz.

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INTRODUCTION

Osteoporosis is one of the most common chronic disorders seen among the elderly people. Increased fracture risk is a well-known entity in osteoporosis and nearly 40 percent of women older than 80 years of age have been reported to have a fracture of the hip, vertebra, wrist, or pelvis (5). Hip fractures have been considered to be the major cause of morbidity and mortality in patients with osteoporosis (2). White women have the highest incidence of hip fractures and the rate increases exponentially after 50 years of age (5). Before the age of 90, rate of hip fractures in women is nearly two times higher than men (2,5). Among hip fractures, nearly 50% are intertrochanteric and 50% femoral neck fractures. Intertrochanteric fractures are generally related to bone density and older women have a higher rate of intertrochanteric fractures. On the other hand, femoral neck fractures are commonly related to mechanical factors (5).

We initially hypothesized that, age, gender, fracture site and laterality might be correlated with the existence and degree of osteoporosis in older patients with proximal femur fractures due to minor trauma. This retrospective study was performed to assess these correlations.

MATERIALS AND METHOD

An institutional ethical board review was not obtained for this retrospective study.

Medical and radiological records of 200 consecutive patients who had proximal femoral fractures due to minor trauma excluding fractures due to tumor or infection, who were at or older than 60 years of age, who had a contralateral hip without any previous surgical intervention due to any reason and who did not have any neurological disorder, were retrospectively investigated. All the fractures occured after a simple fall at home or outside. There were 117 women (59%) and 83 men (41%). Mean age of the patients was 74.5 ± 8.4 (60-99) years. There were 76 (38%) femoral neck and 124 (62%) intertrochanteric fractures. The affected side was right in 98 (49%) and left in 102 (51%) patients. All the patients were surgically treated using either internal fixation or endoprosthesis.

The preoperative grade of osteoporosis was assessed by the classification system of Singh (9) (Table 1) in the unaffected contralateral hip on a standard anteroposterior pelvic radiograph. Grades 5 and 6 were initially considered "no definitive osteoporosis", grades 3 and 4 "borderline/mild osteoporosis" and grades 1 and 2 "moderate/severe osteoporosis" (9). Two authors concomitantly evaluated the level of osteoporosis according to the grading system of Singh to avoid any bias. An additional study on intraobserver or interobserver measurement validity was not made.

Tablo 1— Radiographic Grading of Osteoporosis According to Singh (9)

Grade	Explanation
1	Principal compressive trabeculae are markedly reduced
2	Only the principal compressive trabeculae are visible
3	There is a break in the continuity of the principal tensile trabeculae opposite to the greater trochanter
4	Principal tensile trabeculae are markedly reduced
5	Principal tensile and compressive trabeculae are visible
6	All the normal groups of trabeculae are visible

The T-test for independent samples was used to compare the age means of two different groups and the chi-square test to compare the ratios related to gender, laterality and fracture site, in two different groups. A p value less than 0.05 was considered significant.

RESULTS

According to the classification system of Singh, grade 1 trabecular pattern was seen in 4 (2%), grade 2 in 32 (16%), grade 3 in 56 (28%), grade 4 in 68 (34%), grade 5 in 31 (16%) and grade 6 in 9 (4%) patients.

Mean ages of the osteoporotic and non-osteoporotic group were similar ($p>0.05$) (Table 2).No significant difference was found between the osteoporotic and non-osteoporotic groups with respect to gender, laterality and fracture site ($p>0.05$) (Table 2).

In the osteoporotic patients with proximal femur fractures, the rate of intertrochanteric fracture was significantly higher in borderline/mild osteoporosis group than the moderate/severe osteoporosis group ($p<0.001$) (Table 3). Mean ages of two groups having different osteoporosis grades were similar ($p>0.05$) (Table 3). The grade of osteoporosis was not related to gender and laterality in the osteoporotic patients with proximal femur fractures ($p>0.05$) (Table 3).

DISCUSSION

Osteoporosis is an age-related disorder characterized by a decrease in bone mass and an increase in fracture risk

Table 2— The Correlation Between The Existence of Osteoporosis and Age, Gender, Fracture site, Laterality in Hip Fractures

	No Osteoporosis (Grades 5&6)	Osteoporosis + (Grades 1 to 4)	P value
No of Patients	40 (20%)	160 (80%)	
Mean Age (years)	75.8 ± 8.1	74.1 ± 8.5	0.254
Sex			
Female	21 (18%)	96 (82%)	0.389
Male	19 (23%)	64 (77%)	
Fracture Site			
Femoral neck	11 (14%)	65 (86%)	0.126
Intertrochanteric	29 (23%)	95 (77%)	
Side			
Right	20 (20%)	78 (80%)	0.888
Left	20 (20%)	82 (80%)	

Table 3— The Correlation Between The Grade of Osteoporosis and Age, Gender, Fracture Site, Laterality in Hip Fractures

	Borderline/Mild Osteoporosis (Grades 3&4)	Moderate/Severe Osteoporosis (Grades 1&2)	P value
No of Patients	124 (78%)	36 (22%)	
Mean Age (years)	74.4 ± 8.1	73.2 ± 9.9	0.448
Sex			
Female	77 (80%)	19 (20%)	0.315
Male	47 (73%)	17 (27%)	
Fracture Site			
Femoral neck	41 (63%)	24 (37%)	<0.001*
Intertrochanteric	83 (87%)	12 (13%)	
Side			
Right	59 (76%)	19 (24%)	0.583
Left	65 (79%)	17 (21%)	

*: Significant difference

especially in the spine, hip and wrist regions (2,5). The importance of hip fractures due to osteoporosis in geriatric patients is a well known entity and it leads to significant medical and social problems. Several factors such as gender, race, radiologic morphometry of proximal femur have been reported to have a correlation with the occurrence of hip fractures (5). In the present retrospective study, it was aimed to assess the correlation between the osteoporosis degree and age, gender, fracture site and laterality in geriatric patients who had a proximal femur fracture due to simple fall.

There are some limitations in this study. First, it is known that quantification of bone mass is necessary for confirmation of the diagnosis and longitidunal follow-up in osteoporosis. Among the radiological imaging techniques, plain radiographs are considered to be the least effective for the exact quantification of bone mass (2). On the other hand, it was reported that, Singh grading system had an acceptable level of correlation with bone mineral density measurements of the hip by the DEXA scans, quantitative computed tomography or microscopic morphometry and could be used to determine the degree of osteoporosis as it might reflect the local cancellous bone quality of the proximal femur (3,6,11). Neverthless, this was a retrospective study and the plain radiographs were the only obtained diagnostic tools for the estimation of osteoporosis and its grade. Secondly, the reliability and reproducibility of Singh's classification system is controversial (10). In the present study, two experienced

authors concurrently made the measurements in order to lessen the risk of measurement variations.

There are a number of studies investigating the correlation between the bone quality and fracture site in proximal femur fractures. In a study performed in patients older than 60 years of age with trochanteric fractures, stable fractures were found to be more frequent in patients with better bone quality (4). In another study, a higher Singh index was found in older patients with intracapsular proximal femur fractures compared to the extracapsular ones as a result of shear forces (8). In an experimental study, it was stated that, femora with lower mechanical strength were more prone to failure at the femoral neck (7). However, these findings (7,8) and the classical belief (5) are different from the findings of the present study. In the present study, the fracture site was similar in non-osteoporotic and osteoporotic patients. However, the rate of femoral neck (intracapsular) fractures increased in patients with moderate or severe osteoporosis and the rate of femur intertrochanteric (extracapsular) fractures was higher in patients with borderline or mild osteoporosis. We may speculate that, when the trabecular structure of the proximal femur is not severely disrupted, the intertrochanteric region seems to be more prone to force applications, so the intertrochanteric fractures are generally related to mechanical factors, especially the type and severity of fall. We may also speculate that, the bone mineral density of the femoral neck region may be worse than the intertrochanteric region in advanced osteoporosis, and this is the reason why femoral neck fractures are correlated with significantly decreased bone density in such patients.

It has been stated that it may be better to predict the factors relating to falls and fracture than directly osteoporosis (1). Women with hip fractures are known to be more osteoporotic than men with hip fractures (2,5). Besides, the rate of hip fracture increases when the patient's age increases (2,5). In the present study we observed that, 80% of the patients with hip fractures had various degrees of osteoporosis, whereas 20% did not have a definitive radiographic osteoporosis. This ratio was almost similar in women and men. Besides this, the degree of osteoporosis was similar in osteoporotic women and men with proximal femur fractures. Age of the patient was similar in osteoporotic and non-osteoporotic groups with fractures as well as in borderline/mild and moderate/severe osteoporotic groups. Based on the findings of the present study, we may suggest that, osteoporosis is not the single risk factor for the occurrence of proximal femur fractures in older patients and women and men with proximal fractures have almost the same degree of ostoporosis. Besides this, both the existence and degree of osteoporosis are not related to age in older patients with proximal femur fractures.

In conclusion, the degree of osteoporosis correlates with the fracture site in proximal femur fractures due to fall in osteoporotic patients at or older than 60 years. Patients with borderline or mild osteoporosis are more prone to intertrochanteric fractures, while the occurrence of femoral neck fractures increases in patients with advanced osteoporosis.

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