

Research Article

Risk Factors for Hip Fracture After Simple Fall in the Elderly Population

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Abstract

Objectives: This study aimed to determine the risk factors for hip fracture after a simple fall and to determine the characteristics of individuals who should have a controlled living space where falling can be prevented.

Methods: Ambulatory patients aged over 65 were retrospectively analyzed and divided into two groups those with hip fractures (study group) and those without hip fractures after fall (control group). Data were categorized as demographic characteristics, comorbidities, location of trauma, and movement-posture at the time of trauma, chronic drug use.

Results: 508 patients were included in the study. There were 179 patients in group 1 and 329 patients in group 2. There was a significant difference in favor of group 1 in terms of concomitant diabetes, chronic renal disease, cardiac disease, coxarthrosis and smoking. In group 1, the most common place of falling was 'bathroom', while in group 2 it was 'living rooms'. The upper extremity injury of the patients in group 2 was found to be higher than group 1.

Conclusion: This study revealed the associated risk factors in hip fractures. Besides, the place where the fall occurred, the activities during the fall, and the accompanying injuries are effective on the occurrence of hip fractures.

Keywords: Hip fracture, fall, aging adults, fracture risk, comorbidity, osteoporosis

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The increase in the elderly population constitutes an important public health problem. Hip fractures are also frequently seen after simple falls, especially in the elderly.^[1] It is well known that mortality after hip fracture is very high in elderly individuals compared to the general population, and this rate is around 20% in the first year after hip fracture in patients over 65 years of age.^[2]

Poor balance, low muscle strength and impaired coordination, fragility are associated with frequent falls in the elderly.^[3] Therefore, maintaining functional capacity is the main factor in preventing falls.^[4] Although fragility increases with age, it is equally important to detect additional factors that may cause fractures after falling. The hip fracture that oc-

curs after a fall is primarily related to the conditions that affect the bone mineral density, but it is also related to the form of the fall or the physical activity during the fall.^[5]

A possible hip fracture can be prevented by predicting the risk factors for hip fracture after a simple fall, identifying individuals with these risk factors, and taking additional precautions such as the necessary community health service or home nursing service.

The primary aim of this study was to determine the risk factors for hip fracture after a simple fall. In addition, it is aimed to determine the preventable causes of fragility and the characteristics of individuals who should have a controlled living space where falling can be prevented.

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Methods

In this study, ambulatory patients over the age of 65 who applied to our hospital's emergency department and orthopedic outpatient clinic between 2020-2022 after falling were retrospectively analyzed.

Study Design

The patients were divided into two groups those with hip fracture (study group) and those without hip fracture (control group) after the fall. Regardless of whether an assistive device such as a cane was used, patients with walking ability were defined as ambulatory. A sudden, unexpected collapse from a standing, sitting or horizontal position without loss of consciousness is also defined as a fall.^[3] Patient data were available from file search, imaging archive, and national personal health information system (e-nabiz). It was categorized while collecting the data. These were; demographic features, concomitant diseases, the place where the trauma occurred, movement-posture at the time of trauma, additional post-traumatic injury, chronic drug use, regular smoking and alcohol use.

Patients

The inclusion criteria of the study were patients over 65 years of age with a level fall.

- After high-energy traumas such as a fall from a height or a traffic accident,
- Refractures on the old fracture,
- Periprosthetic or peri-implantic fractures,
- The presence of diseases that cause collagen and bone tissue disorders such as osteogenesis imperfecta,
- Patients whose personal information cannot be reached or do not want to share it,
- Patients with isolated trauma-related fractures (ankle sprains; malleolus fractures, Jones fractures, etc.)
- Patients under 65 years of age,
- Those with neurological diseases affecting the level of consciousness were excluded from the study.

Statistical Analysis

SPSS 15 (SPSS Inc., Chicago, USA) program was used to investigate the statistical relationship. Mean, standard deviation, minimum and maximum values were taken in the descriptive statistics of the data. The distribution of variables was measured with the Kolmogorov-Smirnov test. Fisher exact test was used for categorical variables and Mann Whitney U tests were used for numerical variables in the analyzes comparing the groups. A P value less than 0.05 was considered statistically significant.

Results

As a result of the retrospective analysis, 547 patients were examined. Thirty-nine of them were excluded from the study because of high-energy injury, inaccessibility of their medical records, and periprosthetic-periimplantic fractures. 508 patients were included in the study. The mean age of the patients was 76.3 ± 8.9 (65-99). 236 (46.5%) of patients were female and 272 (53.5%) were male. According to the group distribution, the number of patients in the study group (Group 1) with hip fracture after falling was 179 (35.2%), and in the control group (Group 2) without hip fracture was 329 (64.8%).

The mean age of the patients in group 1 was 76.9 ± 9.2 (65-98), and the mean age of the patients in group 2 was 75.9 ± 8.8 (65-99). There was no significant difference between the groups in terms of mean age ($p=0.298$). Of the patients in Group 1, 109 (60.9%) were female and 70 (39.1%) were male. Of the patients in Group 2, 127 (38.6%) were female and 202 (61.4%) were male. Considering the gender distribution between the groups, a significant difference was found in favor of female gender in group 1 ($p<0.001$). While the mean body mass index (BMI) of all patients was 28.1 ± 5.5 (19-45), the mean of the patients in patients group 1 was 27.8 ± 5.4 (19-45), and the mean of patients in group 2 was 28.2 ± 5.5 (19-45) ($p=0.566$).

There was a significant difference in favor of group 1 in terms of concomitant chronic diseases, especially diabetes, chronic renal disease and cardiac disease of the patients who applied with a diagnosis of fall ($p<0.001$) (Fig. 1). Considering chronic drug use, 129 (72.1%) of the patients in group 1 had chronic drug use, while 107 (32.5%) of the patients in group 2 had chronic drug use ($p<0.001$). In terms of smoking and alcohol use, 69 patients (38.5%) used cigarettes and 44 patients (24.6%) used alcohol in group 1, while 96 patients (29.2%) used cigarettes and 75 patients (22.8%) used alcohol in group 2. While there was no statistically significant difference between the groups in terms of alcohol use ($p=0.650$),

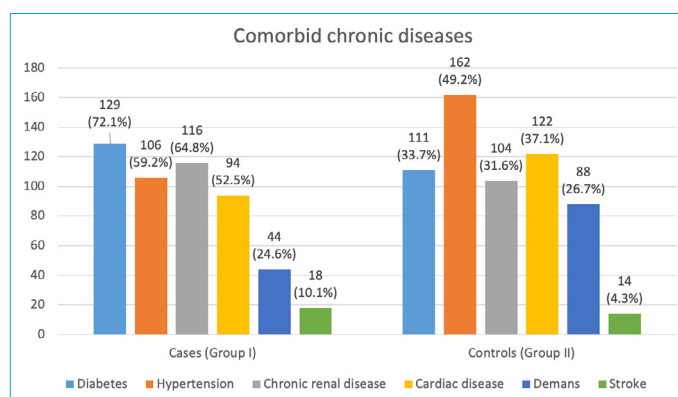


Figure 1. Comorbid chronic diseases of patients presenting with falls.

there was a significant difference between the groups in terms of smoking ($p=0.031$). When those with coxarthrosis were examined, there were 76 (42.5%) patients in group 1 and 82 (24.9%) patients in group 2 ($p<0.001$).

When the activity during the fall was examined, the highest activity in both groups was found to be 'walking', and when all activities were examined, a significant difference was found between the two groups ($p=0.003$) (Table 1). There was also a significant difference between the groups between the places where the fall occurred ($p<0.001$). While 'bathroom' was the most common with 77 patients (43.0%) in group 1, 'living rooms' was found the most with 134 patients (40.7%) in group 2 (Table 2). As the reason for falling, in both groups, tripping was the first and slipping was the second reason (Table 3). A statistically significant difference was found between the groups ($p=0.005$).

Additional injuries after falling are given in Table 4 and no significant difference was found between the two groups ($p=0.137$). While 37 (20.7%) patients in group 1 were using assistive walking devices, 139 (42.2%) patients in group 2 were using assistive devices ($p<0.001$).

Discussion

Simple falls are the most common cause of hip fractures. For this reason, it is of great importance to reveal and try to prevent both simple falls and hip fracture risk factors. This study also showed that elderly individuals with post-fall hip

fractures have a higher incidence of diabetes, chronic renal disease, and cardiac diseases than those without hip fractures. Consistent with our results, Covino et al.^[6] stated in their study that the risk of hip fracture increased in patients with chronic renal failure, while Fan et al.^[7] also revealed that diabetes is a risk factor for hip fracture.

Female gender is seen as a risk factor for hip fracture due to osteoporosis, especially in the postmenopausal period.^[8] We also found that hip fractures were significantly higher in females than males after falling. In addition, it has been shown that chronic diseases and related multiple drug use may increase the risk of hip fracture by causing osteoporosis.^[9] In our study, the use of multiple drugs was found to be significantly higher in patients with hip fractures. A high body mass index reduces the risk of osteoporosis due to the load on the bones, while diabetes-related abdominal obesity increases the risk of fracture by causing osteoporosis.^[10,11] However, in our study, no difference was found between those with and without hip fracture in terms of body mass index. It can be said that the reason for this may be the mechanical protective effect of the adipose tissue around the hip.

In our study, we observed that falling most frequently occurred while walking, and secondly, it occurred during the act of standing up in both groups. In this series, 37% of patients with hip fractures reported falling while walking. Similarly, Cumming et al. reported this rate as 41% in their

Table 1. Comparing activity at time of fall among groups

Activity	Cases (Group 1) n (%)	Controls (Group 2) n (%)
Walking	67 (37.4)	155 (47.1)
Bending over	18 (10.1)	48 (14.6)
Getting up	34 (19.0)	54 (16.4)
Sitting down	19 (10.6)	23 (7.0)
Turning around	27 (15.1)	19 (5.8)
Using stairs	14 (7.8)	30 (9.1)
Total	179	329

Table 2. Location of falls among groups

Location	Cases (Group 1) n (%)	Controls (Group 2) n (%)
Living rooms	50 (27.9)	134 (40.7)
Bathroom	77 (43.0)	51 (15.5)
Outside	38 (21.2)	122 (37.1)
Stairs	14 (7.8)	22 (6.7)
Total	179	329

Table 3. Causes of falls in cases among groups

Cause of Fall	Cases (Group 1) n (%)	Controls (Group 2) n (%)
Trip	107 (59.8)	217 (66.0)
Slip	51 (28.5)	73 (22.2)
Loss of balance during postural change	6 (3.4)	28 (8.5)
Dizziness or loss of consciousness	15 (8.4)	11 (3.3)
Total	179	329

Table 4. Distribution of additional injuries after falling by groups

Additional injury	Cases (Group 1) n (%)	Controls (Group 2) n (%)
None	114 (63.7)	172 (52.3)
Upper extremity/soft tissue injury	36 (20.1)	96 (29.2)
Upper extremity/fracture	19 (10.6)	43 (13.1)
Lower extremity/soft tissue trauma	6 (3.4)	10 (3.0)
Lower extremity/extra-hip fracture	4 (2.2)	8 (2.4)
Total	179	329

series.^[12] Another remarkable finding in the study was that patients who fell during the 'turning around' had a significant hip fracture (59%). While the literature reports similar results, there is not enough clarity about the mechanism.^[3,12] However, one of the most valid hypotheses is that patients with increased hip joint arthrosis develop proximal femur fractures, especially due to difficulties in performing rotational movements.^[13] In our study, we found a significant presence of coxarthrosis in patients with hip fracture after falling, supporting this.

Although there are studies showing that there is no difference in terms of where the fall occurs, it is also reported in the literature that domestic falls are high.^[14-17] In our study, tripping was the most common cause of falling, and this rate was similar both inside and outside the home during walking. The second reason for falling was slipping, and it was found that it occurred most frequently in the bathroom/toilet. Khadgawat et al. reported that 51.5% of hip fracture patients fell in the bathroom in their series, while Mandl et al. also reported that 45.8% of the patients in their series fell during the use of the bathroom.^[18,19] It should also be kept in mind that drugs used for comorbidities, especially thiazide-derived diuretics, may also be a risk factor for hip fracture in elderly patients by increasing urinary frequency and causing osteoporosis.^[20,21] Similarly, diabetes causes both osteoporosis and polyuria-nocturia. Similarly, diabetes can be considered as a risk factor for both osteoporosis and falls resulting in hip fractures by causing polyuria and nocturia and causing more frequent use of the bath/toilet, especially in elderly individuals with low cognitive function capacity.^[22,23]

Although simple falls are known to be predisposed to hip fractures, they are also a risk factor for concurrent upper extremity injuries, especially distal radius fractures.^[24] In our study, upper extremity soft tissue and osseous injuries were the most common accompaniments of hip fracture after a fall with 30.7%. Another important point was that upper extremity injuries were seen 42.3% more in the group without hip fracture after falling. This is also found in the literature as a protective mechanism.^[25] Feldman et al. reported in their series that the risk of hip fracture can be reduced by softening the severity of the trauma, especially by falling on the hand.^[26] In parallel with the rates in our series, upper extremity injuries in elderly patients have attracted attention as a factor that reduces the risk of hip fracture, both by reducing the severity of trauma and by showing that the patient's mobility and cognitive capacity are high.

This study includes some limitations. Among these, the presence of osteoporosis, which is known to be a risk fac-

tor for hip fracture and is generally accepted, could not be standardized by bone mineral density measurement. Likewise, patients treated for osteoporosis were not separated from other patients.^[27,28] However, although the test measurement was not taken into account, the age of the patient over 65 reflects the presence of osteoporosis and provides a kind of standardization.^[29] Another limitation is that patients who were not admitted to the hospital after a fall were not included in the control group. Although this creates doubt in terms of the control group sample reflecting society, we believe that it is valuable in terms of standardizing traumas of a certain severity.

Conclusion

This study showed that diabetes, chronic renal disease, cardiac disease, coxarthrosis, smoking and chronic drug use are risk factors for hip fracture in patients presenting with falls, especially in geriatric patients. In terms of the location of the fall and the activities during the fall, slipping while using the bathroom/toilet in the home is significant in terms of hip fracture. Upper extremity injuries accompanying falls and high mobility protect them from hip fractures.

Disclosures

Ethics Committee Approval: The protocol of the study was approved by the Medical Ethics Committee of İzmir Katip Celebi University Faculty of Medicine, İzmir, Turkey. (Decision number: 0594-2022).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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