



From the Fall to the Theater - Early Acute Phase in Osteoporotic Hip Fractures

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ABSTRACT

Objective: There is a lack of information regarding the period between the occurrence of fracture and time until surgical treatment. Despite the presence of epidemiological data on hip fracture, more detailed estimates of time and site of hip fractures are necessary to develop effective fracture prevention policies. The aim of this study is to analyze characteristics of falls resulting in hip fracture in Turkish patients and to document what happens in the early acute phase of the fracture.

Methods: A questionnaire was applied to the patients who were hospitalized for osteoporotic hip fracture. The questionnaire included demographic variables, fall frequency, time of fall, site of fall, time taken for admission to health-care, time until operation.

Results: The study included 31 female (47.7%) and 34 male (52.3%) patients. The mean age of the population was 79.1 ± 6.7 (range, 54–90 years). Of all fractures, 73.8% (n=48) occurred during the day between 06:00 am and 18:00 pm, and 69.2% (n=45) of the fractures occurred indoors. Most of the fractures occurred on the non-dominant side (n=45; 69.2%). Forty-three patients (66.2%) were admitted to the health care center in less than 2 hours. However, most of them were operated (n=41; 62.1%) after 48 hours of hospital admission.

Conclusion: Osteoporotic hip fractures occurred indoors and during the day in Turkish patients. Educational programs may be introduced focusing on indoor precautions for fracture prevention and on increasing osteoporosis awareness. Hip fracture teams may be organized in emergency units. (*JAREM* 2015; 5: 110-4)

Keywords: Hip fractures, osteoporosis, awareness

INTRODUCTION

Fractures in the elderly population are predominantly due to the presence of osteoporosis and falls (1). The annual cost attributable to osteoporotic fractures in England and Wales is 1.7 billion, and over 90% of this cost is due to hip fracture (2). The lifetime risk of hip fracture for a white woman aged 50 years is reported to be up to 11%–17.5% (3, 4). The mortality of hip fracture in elderly is high, and it is the cause for restricting participations in most of the survivor patients (5). At above 75 years of age, hip is the predominant site of fracture, and most of the hip fractures were caused by low-energy fractures (6).

Bergström et al. (6) analyzed fracture mechanism in both men and women aged over 50 years in Sweden. Hip fractures were mostly a result of low-energy trauma and occurred mainly in elderly. There was no seasonal variation of hip fractures. The data of the abovementioned study was from a population-based register.

Despite the presence of epidemiological data on hip fracture, little is known about the early acute phase of the fracture. To our knowledge, little investigation has been conducted regarding what happens immediately after the fracture when the patients are admitted to the healthcare center and when they are treated. Moreover, estimates of site and time of fall causing hip fracture are needed to guide fracture prevention policies, but there are few recent studies reporting these statistics (1, 6).

The objective of this study is to investigate the characteristics of fall resulting in hip fracture in Turkish patients and to obtain information on the duration of early acute phase after the fall to the surgical treatment.

METHODS

Patients and Outcome Measures

The present study was conducted in an industrialized middle-sized city of western Turkey, Denizli, in a state hospital. This hospital is one of the three largest hospitals in the city with an annual census of 1380000 patients.

All patients with occupational injuries referred to the emergency unit within a 1-year period were prospectively investigated. Patients who were hospitalized for osteoporotic hip fracture were evaluated in the study. We evaluated 80 patients during the study period. The following patients were excluded from the study: patients with a pathological femur fracture, patients who were not able to complete the questionnaire, patients with high energy fall, patients who experienced hip fracture without a fall pushing the chair with his leg. Finally, the study included 65 patients.

A questionnaire comprising demographic parameters (such as age, weight, height, and educational status), diagnosed comorbidities, risk factors for fracture, previous diagnosis and treatment of osteoporosis, ambulation status before fracture evaluated using functional ambulation scale, fall frequency, time of fall, site of fall, time to admission to health-care, time to operation



was applied. The height of the non-ambulatory patients was measured while they were lying down in the bed. The area from the patients' head to their feet was marked. The distance between the marks was measured to estimate the height of the patient. The weight of the patient was measured with a bed scale when the patient was lying down.

Functional ambulation scale (FAS) assesses functional ambulation in patients. Patients can be rated as follows between scores of 0–5:

- 0: Patient cannot walk without assistance from two or more persons.
- 1: Patient needs firm continuous support from one person to bear weight and achieve balance.
- 2: Patient needs continuous or intermittent support from one person to help with balance and coordination.
- 3: Patient requires supervision as stand-by help or verbal feedback from one person without physical contact.
- 4: PATIENT can walk independently on levelled ground but requires help on stairs, slopes, or uneven surfaces.
- 5: Patient is completely independent while walking.

The study was approved by the local ethical committee. Written informed consent was obtained from the patients.

Statistical Analysis

Statistical analysis was performed using SPSS software, version 17.0, (SPSS Inc.; IBM Company, Chicago, IL, USA). Standard descriptive statistics was used to summarize the participants' characteristics, which included means and standard deviations (SD) of all continuous variables, as well as counts and percentages for the categorical variables. We defined two-sided statistical significance as $p < 0.05$. The effect of age and gender on the site of fall was further analyzed by the independent sample t-test.

RESULTS

The study included 31 female (47.7%) and 34 male (52.3%) patients. The mean age of the population was 79.1 ± 6.7 (range, 54–90 years). The mean body mass index (BMI), weight, and height were 23.8 ± 4.1 kg/cm², 62.35 ± 12.2 kg, 161.85 ± 8.2 cm, respectively. BMI ranged between 16.6 and 38.94 kg/cm², weight ranged between 37 and 106 kg, and height ranged between 140 and 180 cm. Thirty-six of the hip fractures were on the left side. Most of the fractures occurred on the non-dominant side ($n=45$; 69.2%). Mean total duration of hospital stay was 12.6 ± 6.3 days.

Ambulation level before fracture, presence of comorbidities, fall frequency, smoking, and alcohol consumption were analyzed. Descriptive characteristics of patients are shown in Table 1. Table 2 presents the distribution of selected variables.

Of the 65 patients with hip fracture, only 17 patients (26.2%) previously had dual X-ray absorptiometry evaluation. Seven patients were undergoing osteoporosis treatment; eight patients were undergoing vitamin D and calcium replacement. Osteoporosis treatment was not initiated in 50 patients before the fracture. Twenty-four patients reported a history of fragility fracture.

Most of the fractures occurred indoors ($n=45$; 69.2%). Fifteen patients fell in the living room, which was the most common site.

Only one patient fell in the kitchen (1.5%). Figure 1 represents the detailed distribution of the sites of fracture. We performed further analysis to evaluate the effect of age and gender on the site of fall. When we compared the age of indoor and outdoor falls, there was a statistically significant difference (p value=0.001; 95% CI: 2.97–10.37). The patients who fell outdoors tended to be younger (mean age: 74.3 ± 8.2 years; range, 54–86) than the patients who fell indoors (mean age: 81 ± 6.5 ; range: 64–90). When we compared the effect of gender on the site of fall, there was a statistically significant difference; outdoor falls were more common in male patients (p value=0.02).

The incidence of the hip fractures according to seasons was as follows: 38% in winter ($n=25$), 25% in autumn ($n=16$), and 18.5% in spring and summer ($n=12$). Of all the fractures, 73.8% ($n=48$) occurred during the day between 06:00 am and 18:00 pm. Fractures were most frequent in the afternoon ($n=27$; 41.5%). More than half of the patients were admitted to a healthcare center in 2 hours after the fall. Admission time was more than 24 hours in only three patients (4.6%). Ten patients were operated within 24 hours of admission; 25 patients were operated after three days of admission.

DISCUSSION

In this study, we aimed to investigate characteristics of fall that resulted in osteoporotic hip fracture. To our knowledge, our study was the first to examine the period between the fall and surgery. According to our results, most of the falls occurred indoors and during the day. The emergency of the case was easily recognized by the patient, and most patients were admitted to the healthcare center in less than 2 hours. However, 24 (36.9%) patients could not be operated within 72 hours due to preoperative consultations of the patients with regard to co-morbidities.

Costa et al. (7) examined the characteristics of osteoporotic fractures in women in a global longitudinal study. This multinational study provided data on when, where, and how osteoporotic fractures occurred. Despite the large study population, the data

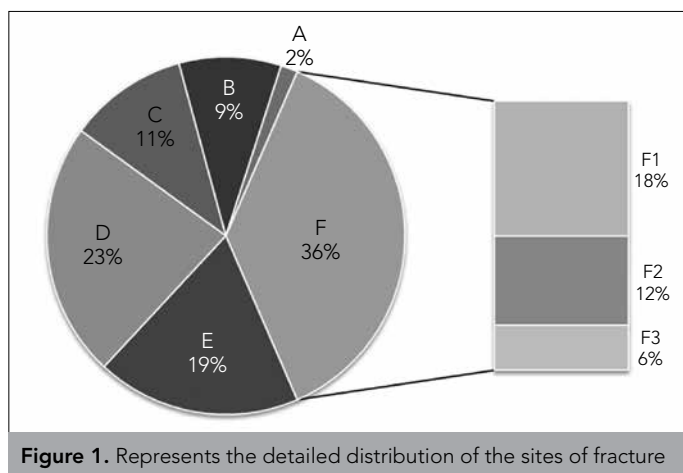
Table 1. Descriptive characteristics of patients

Demographic variable	Number
Age	
<65	5
65-74	11
75-85	36
>85	13
Gender	
Female	31
Male	34
Educational status	
Primary school or less	49
Elementary school	15
High school and more	1

Table 2. Distribution of selected variables

Selected variable	Number	(%)
Body mass index		
<19	6	9.2
19-25	42	64.6
>25	17	26.2
Ambulation level		
FAS Grade 1	1	1.5
FAS Grade 2	1	1.5
FAS Grade 3	4	6.2
FAS Grade 4	27	41.5
FAS Grade 5	32	49.3
Comorbidities		
1	33	50.8
2	21	32.3
>2	11	16.9
Fall frequency		
Less than once a year	39	60
More than once a year	26	40
Smoking		
Current smoker	5	7.7
Ex-smoker	11	16.9
Non-smoker	49	75.4
Total	65	

FAS: functional ambulation scale

**Figure 1.** Represents the detailed distribution of the sites of fracture

on the characteristics of the fracture mechanism was relatively rough. The authors investigated only seasonal variation, outdoor-indoor distribution, and fall mechanism.

Schwartz et al. (8) studied the characteristics of fall and hip fracture risk in elderly men in the United States. They mainly analyzed

the orientation of fall and reported that hitting the hip/thigh during fall was associated with an increased risk of fall. The site and time of fall were out of the scope of this study.

Gemalmaz and Oge (9) documented that knowledge and awareness regarding osteoporosis among rural Turkish women were low, particularly in the older age groups. Another study regarding the knowledge of osteoporosis in Turkish patients documented that only 54% of the patients undergoing treatment were aware of their disease (10). Likewise, one of the most striking results of this study is that although 24 patients had a history of fragility fracture, only 17 underwent DXA investigation; 15 patients were under osteoporosis treatment when fracture occurred. Therefore, appropriate educational programs on osteoporosis should be planned to target mainly geriatric population.

There are different definitions of fall in the literature (11-13). Chu defines fall as "an event that results in a person coming to rest unintentionally on the ground or other lower levels not due to any intentional movement, significant intrinsic event (e.g., stroke), or extrinsic force". The annual prevalence rates for low-impact falls were within the range of 0.217–0.625 in Western cohorts (1). In individuals aged over 75 years, low-energy trauma was responsible for more than 80% of all fractures. The risk of falling increases with aging and approximately 90% of the hip fractures result from low-energy fractures (14, 15). However, only 1% of the falls in elderly result in hip fracture, suggesting that circumstances of fall affect the likelihood of fracture (14).

Bergström et al. (6) analyzed fracture mechanism in men and women aged 50 years and above using a 12-year population-based injury register. They reported an indoor predominance of hip, pelvic, and vertebral fractures. Another recent study investigated the mechanism of hip fracture in Nigeria. They analyzed all hip fractures in all age groups from hospital records. Eighty-six percent of the hip fractures resulting from low-energy falls occurred indoors (16). Costa et al. (7) examined the site and time of osteoporotic fractures in women in a longitudinal cohort. However, they reported fairly even distribution of the sites of fracture between indoors and outdoors when the hip fracture is taken into account. The study population of this cohort comprised ambulatory women as they were recruited from the primary care registry that may explain the even distribution of fracture sites. In our study, almost twice the number of patients fell inside their home as that who fell outside their home ($n=45$; 69.2%); this finding was consistent with those of the previous studies. This may be due to the decreased socialization of patients with increasing age. In this study, the most frequent site inside the house where falls occurred was the living room. There are possible explanations for increased falls in the living room. First, the living room is possibly that part of the house where an elderly individual spends most of her/his time. Second, sessions of sitting without moving and making quick transitions may occur in the living room. For example, reading on a sofa for some time and standing up to attend the ringing phone may cause dizziness and falls. Third, the fear of falling of elderly may be least in the living room compared with that in the other parts of the home such as stairs and bathroom. Decreased self-attention for falling may increase the risk of falling.

We also analyzed the effect of gender and age on the site of fall. There was a statistically significant relationship between increasing age and site of fall. The older patients tend to fall inside while younger patients tend to fall outside the house. This is possibly because of decreased socialization with increasing age. We also found statistically relevant relation between gender and site of fall. Males are at a higher risk of outdoor falls, whereas females have an increased likelihood of indoor falls. This may be a clue when informing osteoporotic patients regarding fall risk, particularly if the time for each patient is limited in one's osteoporosis clinic. More effort may be spent on risk factors outside the house when dealing with male patients. On the other hand, female patients may be informed mostly regarding indoor risk factors during the osteoporosis follow-up.

The question of when fractures occurred is investigated mainly from the seasonal point of view in the literature. The effect of seasons on hip fracture is under debate. Despite studies reporting seasonal increases in hip fracture (7, 17, 18), constant seasonal variation was also reported (6). Our study was conducted throughout the year, and the number of fractures were highest in winter. Bergström et al. (6) stated that the number of hours of day/daylight was not important for fractures in patients aged 50 years and above. However, falls resulting in hip fracture appeared to be slightly more frequent during the day in our study (n=48; 73.8%). Daylight means more time spent awake in addition to increased risk of falling. This may explain the tendency of hip fracture to occur during the day in our study.

To our knowledge, this study is the first to examine the period between the fall and the surgical treatment. Forty-three patients (66.2%) were admitted to the healthcare center in less than 2 hours. The inability to stand up or to bear weight on the affected hip helps the patient to easily recognize the emergency of the situation. Although patients were promptly admitted to the hospitals, 41 patients were operated (62.1%) after 48 hours of hospital admission. This delay is probably due to the efforts for the stabilization of comorbidities of the patient. Hip fracture teams that are similar to stroke teams may be organized in emergency units to decrease the time until operation, particularly in reference hospitals. None of the patients pre or post-operatively died after the admission to the hospital.

One of the limitations of this study is the limited number of patients. It is obvious that careful preoperative assessment and anesthetic plan together with necessary consultations are vital in this kind of a geriatric group. This may explain why it was not possible to perform emergency surgery in hip fractures. Further studies are needed to indicate the differences between the patients who are operated within the first 24 hours and the remaining patients.

CONCLUSION

In the light of our results, we may conclude that hip fractures tend to occur indoors and during the day in Turkish elderly. Educational programs may be introduced focusing on the awareness of geriatric patients regarding osteoporosis and fractures. Indoor precautions to prevent falls and fractures may be integrated to routine geriatric follow-up. Early diagnosis and treatment of osteoporosis as well as increasing self-attention for falling, individualizing fall prevention strategies may decrease the incidence of falls and hip fracture.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Pamukkale University.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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