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Original Article

Fall behaviors and risk factors among elderly patients with hip fractures

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Keywords
Geriatric nursing; Perioperative nursing; Aged; Hip injuries; Fractures; Risk factors

Descritores
Enfermagem geriátrica; Enfermagem perioperatória; Idoso; Lesões do quadril; Fraturas; Fatores de risco

Abstract

Objective: The aim of this study was to investigate fall preventive behaviors in elderly patients who suffered hip fractures as a result of falling.
Methods: This descriptive and cross-sectional study was performed at a university hospital in Izmir, Turkey between January 2014 and December 2015. Data were collected using the Fall Behaviors Scale for Old People. This study was conducted with 103 patients who had a hip fracture caused by falling. Descriptive statistics, Mann Whitney U and Kruskal-Wallis tests were used.
Results: There was a significant difference between age groups in this score (KW = 6.85, p = 0.03). The patients aged 85-96 years obtained significantly higher scores for the sub-scales of *protective mobility* (KW = 8.71, p = 0.01) and *avoidance* (KW = 6.03, p = 0.04) than patients in the other age groups. There was not a significant difference in fall prevention behaviors between the elderly with a history of a repeated falls and those without a repeated fall history.
Conclusion: Although elderly people with hip fractures due to falling has highly protective behavior, they have fallen. Advanced age patient has showed more protective behavior for falling.

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Introduction

Falling can lead to health problems and other major issues,[1,2] including injuries, hospitalization, increased health costs and death, for the elderly population.[3-5] Studies from a variety of contexts have reported that about 30% of older people experience at least one fall each year.[6] Furthermore, in the United States, approximately 30-50% of people living in long term care institutions fall each year, and 40% of them experience recurrent falls.[7] Falls are the cause of approximately 95% of all hip fractures among the elderly; 20% of elderly adults suffering from hip fractures die within a year following the incident.[1] According to data from the International Osteoporosis Foundation (IOF), 1.6 million hip fractures occur annually; by 2050, the incidence is expected to increase by 310% in men and by 240% in women and to reach up to 4.5–6.3 million annually.[8] Reduction of bone density, osteoporosis, low calcium level, low body mass index, muscle weakness, neuromuscular diseases, perception disorders, such as dementia and Alzheimer's, visual disorders, lack of environmental arrangements to prevent falls, chronic diseases, and hasty behaviors are included among the causes responsible for the falls that occur among elderly people with hip fractures. The inability of elderly people to manage their diseases, as well as the impact of multiple drug use, can also cause them to fall.[9,10]

Fall behaviors include both fall risk behaviors and fall prevention behaviors.[11,12] Risky behaviors, such as hastiness, carelessness, the improper use of device aids, the wearing of the wrong shoes and lack of exercise, can compound the risk of falls among the elderly.[3,4] Various studies have reported that the precautions the elderly took to prevent falls included asking for assistance when inserting light bulbs, avoiding risky behaviors, moving slowly and using equipment to support their walking.[13–15] Stevens, Noonan and Rubenstein (2010) recommended that fall prevention programs be evaluated in order to improve fall prevention behaviors among the elderly.[16] The most frequently displayed fall prevention behavior among the elderly are exercise, vitamin D supplementation, environmental modification, education, and multi-factorial programs. Three recommendations have been made to achieve behavioral changes for prevention of falls at home: provide education about the risk factors related to falls, target behavior and raise awareness about the risk factors for falls, and remove environmental risk factors for falls (e.g., clutter) or install protective equipment (e.g., night lights or grab bars).[8,17-19]

Fall behaviors among elderly people have not been extensively explored. Consequently, there is only a limited amount of literature on fall behavior risk factors specific to hip fractures caused by falling. By conducting an assessment of fall behaviors, repeated falls after orthopedic surgery, particularly hip surgery, can be prevented.[20] In the literature review, there were no studies that specifically evaluated fall-related prevention behaviors among elderly people who have had hip fractures. Therefore, the purpose of this study is to investigate fall preventive behaviors in elderly patients who suffered hip fractures as a result of falling.

Methods

Design, setting and participants

This descriptive and cross-sectional study was conducted at Dokuz Eylul University hospital, located in Izmir, Turkey. The study was performed in the orthopedics and traumatology clinic between January 2014 and December 2015. The orthopedics and traumatology clinic has a 60-bed capacity. In particular, patients between the ages of 10 and 96 who have been diagnosed with fractures, osteoarthritis, or scoliosis receive care here.

The study population comprised elderly people aged ≥65 who were registered with hip fracture due to falling in the clinic. The calculation of the sample size was based on the number of hip

fracture with elderly people enrolled in the health information system in 2013 in the orthopedics clinic. We determined the minimum sample size to be 97 with a 5% margin of error, and 95% confidence interval. The study included 103 elderly patients. These patients were selected according to the following inclusion criteria: 65 years or older and have a hip fracture caused by falling. The sample exclusion criteria, on the other hand, were that the patients have cognitive disorders, severe vertigo or speech disorders and that they had experienced a high-energy trauma fall.

The patients who agreed to participate in the study signed the Informed Consent form. Data collection tool was administered by the second author during face-to-face interviews. The interviews took place in the patients' rooms and lasted 10-15 minutes.

Data were collected using the Socio-demographic and Clinical Characteristics Form designed by the researchers based on the literature, and the Fall Behaviors Scale for Old People (FaB)[12] The Socio-demographic and Clinical Characteristics Form included 8 questions focusing on age, gender, educational status, occupation, whether the patients lived alone, the anatomical area of the fracture, the number of chronic diseases, and the number of falls within the past year. The second author inquired of the participants whether they had experienced another fall, one before the hip fracture they suffered from falling, during the past year. The number of falls was then recorded according to the participants' responses.

The FaB was developed by Clemson, Cuming and Heard in 2003, and a Turkish translation, validity test, and reliability test of the scale were performed by Uymaz and Nahcivan.[21] The scale was employed among community-residing older adults to assess the behaviors and actions they practiced to prevent falling.[21–23] This scale is a self-rating measure, but it can also be used in interviews. The purpose of its design was to assess seniors' awareness of behaviors that could be potentially protective against falling. The higher the score, the more likely a person engages in fall prevention behaviors, while a lower score suggests risky behaviors. The scale is composed of 10 subscales and 30 items. The subscales are: (1) *cognitive adaptations (six items),* which involves thinking and planning, (2) *protective mobility (5 items),* which involves supportive/preventive measures and environmental assessment for balance, (3) *avoidance (5 items),* which involves avoiding risky behaviors related to falling, (4) a*wareness (4 items),* which involves the hazards, of which individuals are aware, in their external environment, such as traffic, (5) *pace (2 items),* which involves individual's hasty behaviors, (6) *practical strategies (3 items)*, which involves prediction of and planning for the hazards related to falling, (7) *displacing activities (1 item),* which involves going out on windy days, (8) *being observant (1 item),* which involves being careful, (9) *changes in level (2 items),* which involves coping with more challenging activities, such as being attentive to the steps when climbing up and down the stairs, and (10) *getting to the phone (1 item),* which involves the measures taken when trying to access things, such as the telephone.[11,21] The scores of 6 items (items 7, 8, 9, 10, 19 and 23) are calculated in the reverse order. Scores for the scale and its subscales are calculated by adding up the points for all the items and dividing the total score by the number of items. The higher the score is the more likely a person engages in the safest fall prevention behaviors, while lower scores suggest more risky behaviors. Scores can range from 30 (risky fall behavior) to 120 (preventive fall behavior).

The original version of FaB is a valid and reliable scale, as confirmed by its high internal consistency reliability, computed by Cronbach's Alpha ($\alpha = 0.84$), and its test-retest reliability correlation coefficient of 0.94 ($p < 0.01$). The validity of the scale, as determined by the content validity index, was 0.93. Cronbach's Alpha coefficients for the subscales varied from 0.10 to 0.81.[18]

The scale was adapted for Turkish culture by Uymaz and Nahcivan.[21] For the adapted scale, the content validity index was 0.94, and the test-retest reliability correlation coefficient was 0.96. The Cronbach's Alpha coefficient was 0.90 for the scale, indicating strong internal consistency, while the Cronbach's Alpha coefficients for its subscales ranged from 0.51 to 0.90. Cronbach's Alpha coefficient was 0.84 in this study sample.

The data analyses were performed using the Statistical Package for Social Sciences (SPSS, v.15.0 for Windows; Chicago, IL). The level of significance was set at ≤ 0.05 for all tests performed. Descriptive statistics were reported as percentages, means and standard deviations, and medians where appropriate (age, gender, education, marital status, occupation, living alone at home, anatomic area of fracture, prior fall history, number of falls, number of chronic diseases, place of fall). Kolmogorov-Smirnov and Shapiro-Wilk tests were used to determine whether the obtained data were normally distributed. Because the data were not normally distributed, non-parametric tests were used in the analysis of the data. Mann Whitney U, Kruskal-Wallis, Pearson's correlation tests were used to compare fall behaviors according to selected risk factors (age, gender, education, marital status, living alone at home, prior fall history, prior fall numbers).

This study was approved by the Ethics Committee of the Dokuz Eylul University, Protocol no=1173-GOA, 2014/04-16 and was conducted according to the ethical guidelines of the Declaration of Helsinki. Verbal consent and informed consent were obtained from all participants.

Results

The mean age of the participants was 78.78 ± 7.49 years (min = 65, max = 96). Among the participants, 70.9% were female, 43.7% had an elementary education, 39.8% were widowed and 68.90% lived with their relatives. Regarding the anatomical area of the hip fracture, 69.9% had intertrochanteric fractures, 28.2% had femoral neck fractures, and 1.9% had femoral head area fractures. Sixty-eight percent of the patients had fallen within the past year prior to their hip fracture caused by falling, and 67.9% had hypertension, 63.1% had diabetes mellitus (Table 1). The median FaB score was 88.04 ± 13.33. There was statistically significant moderate correlation between fall number and age (r =31, p = 0.01).

Table 1. Sociodemographic and clinical characteristics of elderly patients with hip fracture (n=103)

Characteristics	$\bar{X}$±SD	Min-Max
	78.78 ± 7.49	65-96
	n	%
Age		
65-74	36	35.0
75-84	48	46.6
85 and above	19	18.4
Gender		
Female	73	70.9
Male	30	29.1
Education		
Literate	40	38.8
Elementary education	45	43.7
High School and above	18	17.5
Marital status		
Married	49	47.6
Widowed	41	39.8
Divorced	5	4.8
Unmarried	8	7.7
Occupation		
Housewife	62	60.2
Civil servant	3	2.9
Retired	38	36.9
Living alone at home		
Yes	32	31.1
No	71	68.9
Anatomic area of fracture		
Femur neck	29	28.2
Intertrochanteric	72	69.9
Femur head	2	1.9
Prior fall history		
Yes	68	66
No	35	34
Prior number of falls		
One	35	34.0
Two	33	32.0
Three	31	30.1
Four	3	2.9
Five	1	1.0
Chronic diseases*		
Hypertension	70	67.9
Diabetes *Mellitus*	65	63.1
Parkinson/Dementia	12	11.6
Thyroid	28	27.1
None	19	18.4
Place of fall		
Indoors	93	90.2
Outdoors	10	9.8

*Patients can select more than one option; SD - Standard Deviation

When the risk factors were assessed according to the FaB total score, there was a significant difference between age groups in this score (KW = 6.85, p = 0.03). The participants aged 85-96 years had higher FaB scores than those aged 65-74 years and those aged 75-84 years (U = 199.500, p = 0.01; U = 353.500, p = 0.15; and U = 772.500, p = 0.37; respectively). When the other selected risk factors,

i.e. gender (U = 950.000; p =0.29), education (KW = 2.84; p = 0.24), marital status (KW = 2.84; p = 0.24), prior fall history (U =1350.500 p = 0.24), prior number of falls (KW = 1.41; p = 0.49), and living alone at home (U = 978.500; p =0.26), were assessed by the FaB score, they were not shown to be significantly different (Table 2).

Table 2. Comparison of selected risk factors according to Fall Behaviors Scale for Old People mean scores (n =103)

Selected risk factors	$\bar{X}$±SD	Test *p	p-value *p
Age group			
65-75	84.41±12.04	KW = 6.85	0.03*
76-85	88.72±13.05		
86-96	93.21±15.01		
Gender			
Female	89.06 ±12.69	U = 950.000	0.29
Male	85.56 ±14.71		
Education			
Literate	90.55±14.09	KW = 2.84	0.24
Elementary Education	86.11±12.35		
High School and above	90.86±11.09		
Marital status			
Married	85.91±12.46	U = 1057.500	0.07
Single	89.98±13.90		
Living alone at home			
Yes	90.03±13.72	U = 978.500	0.26
No	87.15±13.15		
Prior fall history			
Yes	89.07±1.63	U = 1350.500	0.24
No	86.05±2.20		
Prior fall numbers			
One	86.05±2.20	KW = 1.41	0.49
Two	88.09±2.04		
3 and above	88.48±2.76		

*P< 0.05; SD: Standard Deviation; KW: Kruskal-Wallis test: U: Mann-Whitney U test

In analyzing the age groups and number of falls according to the FaB subscales, significant differences were identified in the subscales of *protective mobility* (KW = 8.71, p = 0.01) and *avoidance* (KW = 6.03, p = 0.04). The participants between the ages of 85-96 obtained significantly higher scores for *protective mobility* than those aged 65-74 years and those aged 75-84 years (U = 202.500, p = 0.01; U = 382.500, p = 0.13; and U = 498.00, p = 0.80, respectively). The participants aged 85-96 years also obtained significantly higher scores for *avoidance* than those aged 65-74 years and those aged 75-84 years (U = 332.500, p = 0.08; U = 202.500, p = 0.01; and U = 763.000, p = 0.35, respectively) (Table 3).

Discussion

Fall prevention behaviors and physical and environmental factors play an important role in fall prevention. Among patients who have had recurrent falls, the identification of behaviors and risk factors for fall prevention is particularly effective. In our study, we found that the mean total score for fall prevention behaviors was 88.04 ± 13.33, which is consistent with the results from the study by Gopaul and Connelly (2011).[24] Elderly individuals who lived in community dwellings[25] or in their homes and carried out daily life activities had higher scores for fall prevention behaviors.[21]

There was a significant correlation between the number of falls and age. Few studies that the number of falls increases with age. Falls rate increases with age due to decline in skeletal muscle mass and strength, and less mobility. Impaired strength is a strong predictor of falls and may also increase the risk of injury from a fall.

Patients aged 85-96 years had higher scores on the FaB scale and on its subscales of *avoidance* and *protective mobility* than the other age groups. Similarly, Studies reported that in discharged elderly patients there was an increased tendency for them to engage in careful behaviors, such as asking for help and avoiding risks to prevent falls.[14] With advanced age, slower movements, difficulty completing daily activities, decreased social activities and increased fear of falling can lead to the elderly taking safer actions.[26] Furthermore, the elderly use assistive devices, such as walking sticks and walkers, which leads them to move more slowly and consequently, to protect themselves and prevent falls.

In the current study, approximately two-thirds of the patients who were admitted to the hospital for falls that led to a hip fracture had previously experienced another fall within the past year. However, having experienced another fall did not affect their current falls. The participants' experience of another fall after having fallen previously indicated poor behavioral and environmental measures and poor management of accompanying diseases and

Table 3. Comparison of selected risk factors according to Fall Behaviors Scale for Old People subscale score (n =103)

Variables	Total scale point		Cognitive adaptation		Avoidance		Awareness		Practical strategies		Displacing activities	
	$\bar{X}$±SS	Test	$\bar{X}$±SS	Test	$\bar{X}$±SS	Test	$\bar{X}$±SS	Test	$\bar{X}$±SS	Test	$\bar{X}$±SS	Test
Age												
65-75 n(36)	84.41±12.04	KW:6.85	18.08±3.17	KW:4.95	16.02±2.57	KW:6.03	11.80±1.58	KW:1.15	7.38±1.38	KW:1.79	3.13±0.86	KW:2.73
76-85 n(48)	88.72±13.05		19.33±2.75		16.47±3.01		12.04±1.87		7.81±2.16		3.08±0.73	
86-96 n(19)	93.21±15.01	p:0.03*	19.84±3.37	p:0.08	17.47±3.31	p:0.04*	12.26±2.02	p:0.56	8.21±2.27	p:0.40	3.36±0.83	p:0.25
Gender												
Female n(73)	89.06±12.69	U:950	19.28±2.86	U:923.5	16.78±2.88	U:908.5	12.09±1.73	U:951.0	7.91±2.13	U:916.5	3.12±0.86	U:956.5
Male n(30)	85.56±14.71	p: 0.29	18.26±3.47	p:0.21	15.83±2.24	p:0.17	11.76±1.95	P:0.28	7.30±2.05	p:0.19	3.23±0.62	p:0.82
Education												
Literate n(40)	90.55±14.09	KW:6.85	19.60±3.09	KW:3.93	16.97±2.97	KW:5.31	11.80±1.85	KW:0.55	8.15±2.25	KW:7.26	3.32±0.69	KW:2.88
Elementary Education n(45)	86.11±12.35		18.73±2.83		16.24±3.63		12.11±1.65		7.35±1.83		3.00±0.95	
High School and above n(18)	90.86±11.09	p:0.03	18.80±2.95	p:0.26	16.73±3.63	p:0.15	12.73±1.66	p:0.75	8.26±2.28	p:0.06	3.13±0.51	p:0.41
Marital Status												
Married n(49)	85.91±12.46	U:1057.5	18.44±2.94	U:915.5	16.08±2.79	U:937.5	11.79±1.60	U:995.5	7.63±2.14	U:958.5	3.26±0.72	U:981.5
Single n(54)	89.98±13.90	p:0.07	19.48±3.13	p:0.06	16.88±3.17	p:0.21	12.18±1.95	p:0.39	7.83±2.11	p:0.23	3.05±0.85	p:0.32
Living Alone at Home												
Yes n(32)	90.03±13.72	U	19.28±3.28	U:1021	17.62±2.74	U:861	12.03±1.95	U:1074	7.84±1.96	U:1100	3.03±0.86	U:1005
No n(71)	87.15±13.15	p:0.31	18.85±2.98	p:0.41	16.00±3.00	p:0.06	11.98±1.73	p:0.65	7.64±2.20	p:0.79	3.21±0.77	p:0.31

Variables	Protective Mobility		Changes in Level		Getting to the Phone		Pace		Being Observant	
	$\bar{X}$±SS	Test	$\bar{X}$±SS	Test	$\bar{X}$±SS	Test	$\bar{X}$±SS	Test	$\bar{X}$±SS	Test
Age										
65-75 n(36)	11.50±3.82	KW:8.71	5.72±1.08	KW:0.27	3.08±1.13	KW:1.56	5.00±1.94	KW:3.39	2.69±0.89	KW:1.19
76-85 n(48)	13.47±2.80		5.70±1.05		2.85±1.22		5.33±2.03		2.60±1.00	
86-96 n(19)	14.47±4.08	p:0.01*	5.84±1.34	p:0.87	3.21±1.13	p:0.45	6.00±2.22	p:0.18	2.52±1.17	p:0.90
Gender										
Female n(73)	13.35±3.98	U:898.0	5.79±1.07	U:993.5	2.91±1.22	U:975.5	5.16±2.07	U:907.0	2.53±1.04	U:1069
Male n(30)	12.05±3.90	p:0.15	5.60±1.19	p:0.44	3.20±1.03	p:0.35	5.79±2.09	p:0.16	2.56±0.85	p:0.84
Education										
Literate n(40)	15.12±4.06	KW:6.62	5.65±1.09	KW:3.35	3.20±1.09	KW:3.35	5.20±2.25	KW:1.87	2.52±1.10	KW:2.72
Elementary Education n(45)	12.08±3.70		5.80±1.12		2.84±1.26		5.28±1.99		2.64±0.88	
High School and above n(18)	13.26±3.59	p:0.06	6.00±1.00	p:0.34	3.06±1.09	p:0.34	6.00±1.64	p:0.60	2.86±1.06	p:0.43
Marital Status										
Married n(49)	12.14±3.68	U:956.5	5.59±1.03	U:964.5	3.08±1.05	U:957.5	5.16±2.00	U:971.5	2.71±0.95	U:956.5
Single n(54)	13.72±4.14	p:0.08	5.87±1.16	p:0.67	2.92±1.27	p:0.71	5.50±2.09	p:0.72	2.51±1.02	p:0.25
Living Alone at Home										
Yes n(32)	13.31±4.13	U:1058	5.93±0.94	U:985.5	2.87±1.31	U:978.5	5.56±1.84	U:1043	2.53±1.07	U:1057
No n(71)	12.81±3.94	p:0.57	5.64±1.17	p:0.26	3.03±1.10	p:0.26	5.23±2.24	p:0.67	2.64±0.95	p:0.55

SD=Standard deviation, KW=Kruskall Wallis, U=ManWitney U

medication. Multi-approach strategies, such as implementing suitable environmental arrangements, providing the patients with education about the issue, and teaching them the exercises to improve muscle strength, can be recommended for patients who do not modify their behaviors to prevent falls.[13] Mobilization in the elderly decreases as a result of weakened reflexes, loss of balance and decreased strength. The restriction of activities may cause falls and increase the risk of falls related to disabilities. Studies have shown that exercise, which is considered a behavior for fall prevention, reduces fall-related injuries.[13,26] In a systematic review, it was stated that the most important behavioral changes to prevent falls can be achieved through the provision of education about exercise, walking and balance.[19] Offering education about isotonic, isometric and muscle strengthening exercises will serve to decrease the degree of injuries from recurrent falls among hip fracture patients.[26] Therefore, comprehensive education programs about exercise should be provided to prevent recurrent falls and the resultant injuries.

Over 90% of the patients fell indoors. There are environmental factors that cause falls indoors and outdoors. Important modifiable environmental risk factors include lighting, stair and bath rails, clutter, gait aids, and wet surfaces. A meta-analysis studied

by Clemson et al.[12] showed that providing home environmental intervention can decrease the risk of falls by 21% and as high as 39% among populations that are at high risks of falls.[27] Risk factors include medication review, environmental safety evaluations, balance and strengthening exercises, and fall behaviours.[28]

The limitation of this study was that it was performed only on elderly patients who were in hospital with hip fractures; the results from the study were therefore unable to be generalized to other populations of patients with hip fractures or other elderly patients and healthy older people.

Conclusion

This study showed that, unlike advanced age, the descriptive and clinical characteristics, such as fall history and gender, did not affect fall preventive behaviors. With aging, the muscle strength and mobility of patients are reduced. The findings from this study indicated that elderly people acted in a more careful manner to prevent falls as their age increased. However, hip fractures still occurred in elderly people due to falls, despite their good fall preventive behaviors. Therefore, in order to prevent falls in elderly people, it is recommended that there be proper management of accompanying diseases and multiple drug use and that secure environmental arrangements be made.

Collaborations

Bilik O, Turhan Damar H and Karayurt O, declare that they participated in the conception of the study, the critical review related to intellectual content, and the approval of the final version for publication.

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