

# Determining the Risk of Falling in Elderly Patients Undergoing Hip Fracture Surgery

**Stanovení míry rizika pádu u starších pacientů, kteří podstoupili chirurgické léčení zlomeniny proximálního femuru**

**E. SEYHAN<sup>1</sup>, I. CAVDAR<sup>2</sup>**

<sup>1</sup> Güülhane Military Academy of Medicine, Haydarpasa Education Hospital, Orthopedic Surgery Department, Istanbul, Turkey

<sup>2</sup> Istanbul University, Florence Nightingale, Faculty of Nursing, Surgical Nursing Department, Sisli-Istanbul, Turkey

## ABSTRACT

### PURPOSE OF THE STUDY

This study examines the risk of falling in elderly patients who underwent hip fracture surgery in the orthopaedic clinic during the postoperative period.

### MATERIALS AND METHODS

This study was a cross-sectional study. The study sample consisted of 71 elderly patients aged more than 65 years undergoing hip fracture surgery. A questionnaire, the Tinetti balance test and the mini-mental state examination (MMSE) were used.

### RESULTS

The analyses included 71 elderly patients with a mean age of 78.45 years. All patients had been hospitalized for hip fracture due to falling, and 29.6% had a history of falling in the one year prior to hospitalization. The mean MMSE score was  $18.37 \pm 6.54$  and the mean Tinetti score was  $11.10 \pm 6.66$ .

### CONCLUSION

We found that as the mean age of the elderly patients increased, the risk of falling also increased and the MMSE scores deteriorate and that the elderly patients living alone were at a greater risk of falling and had worse cognitive function, that those with a history of falling before hospitalization were at a greater risk of falling again and that the risk of falling increased as cognitive function declined.

**Key words:** elderly, falling, hip fracture, risk of falling.

## INTRODUCTION

The elderly population has been increasing due to the prolonged life expectancy and lower birth rate around the world (24). Today, the world's population has exceeded 6 billion, and there are some 600 million people aged 60 and over worldwide, and 390 million people are over 65 years of age (22). According to the 2013 Turkish Statistical Institute, the share of the elderly in the total population is 7.7% (21).

Falls are a major problem for the elderly. The consequences of falls in elderly people are often traumatic. The risk of injury in the elderly is increased by factors such as decreased visual and hearing ability, reduced control of balance, increased need for medication and gait disorders (7). Approximately one third of individuals aged 65 years or older experience at least one fall each year (24). The tendency to fall increases with advanced age. Eighty percent of the individuals aged 80 years experience at least one fall a year (14). In Turkey, it was found that 60% of falls in individuals 65 years of age occur in the home, 30% in social areas and 10% in health care facilities (15). A study conducted in Turkey demonstrated that half of the 160 elderly per-

sons surveyed had experienced a fall previously, and 23.8% of them had fallen within the six months prior to the study (24).

Environmental factors and a history of falling, balance and gait disorders, visual problems, chronic diseases (such as diabetes mellitus (DM) and Parkinson's disease), postural hypotension, urinary incontinence, hypertension, medication, use of walkers, depression and cerebrovascular disease have been reported to be the cause of falling (4).

Hip fractures are frequently seen in the elderly. One of the most traumatic experiences for the elderly is hip fracture, which may lead to severe morbidity and mortality (18). Falls resulting in various bone fractures, particularly hip fracture, in elderly individuals are a major factor increasing immobility and the risk of being bedridden (14). Hip fracture is associated with high costs in terms of medical care, and it affects the functional abilities and independent living of elderly people (3).

The risk of falling is considered to be higher among individuals and elderly people requiring surgical treat-

ment. It is also suggested that a majority of falls in the hospital setting can be prevented by adopting certain measures, and the first step for this is to identify those at high risk (5). As far as we are aware, there are a limited number of studies aimed at determining the risk of falling after hip fracture surgery in the elderly. The aim of study was performed to investigate the risk of falling in elderly patients who underwent hip fracture surgery at an orthopaedic clinic during the postoperative period.

## METHODS

This study was a cross-sectional study. The study sample consisted of 71 elderly patients aged more than 65 years undergoing hip fracture surgery, who had no communication problems, were willing to participate in the study and were admitted to the Gulhane Military Academy of Medicine (GATA), Haydarpasa Education Hospital Orthopedic Surgery Department, in Istanbul, Turkey. The study was conducted between February and October 2010. All participants had previously agreed to take part in the study. Face-to-face interviews were administered with the participants for data collection. After the patient data form was filled out by the investigator, cognitive function was evaluated using the MMSE. Then, sitting, rising and standing were evaluated on the basis of specific scoring criteria using the Tinetti balance scale. Elderly gait and balance in the postoperative period were measured. The interview took about 40 minutes. The ethics committee of Gülhane Military Academy of Medicine gave permission for the study and ethical approval was granted on 16/02/2010.

### Study instruments

**Patient data form:** Patient data forms included individual characteristics (sex, age and lifestyle) and health characteristics (hypertension, arthritis, DM, visual and hearing impairment, cardiovascular disease and the presence of cerebrovascular disease).

**Cognitive state:** This mini-mental state examination (MMSE) was used. It was developed by Folstein et al. in 1975 to determine the cognitive state of elderly people and was verified and validated by Güngen et al. (12) for a Turkish population aged 60 years and older in 2002. This test addresses the following cognitive areas: orientation, memory, attention and calculation, recall and language. The test is scored out of 30 points, from normal (30) to severe dementia (0), with any score below 23 indicative of cognitive impairment.

**Tinetti balance scale:** The Tinetti balance scale, developed by Tinetti in 1986 and verified and validated by Ağrıcan (1) for the Turkish population in 2009, assesses the balance status of the elderly during sitting, rising and standing. It evaluates the elderly during activities scored on the basis of predefined qualitative criteria. The Tinetti balance scale consists of gait and balance subscales. Evaluation is made on the basis of specific scoring criteria for each activity. The maximum score for the gait subdimension is 12 points and the maximum

Table 1. Distribution of elderly patients' characteristics (n = 71)

Variable	n	%	Mean ± SD	Min-Max	
Sex	female	59	83.1		
	male	12	16.9		
Age				78.45 ± 7.37	65–91
Lifestyle	single	13	18.3		
	with partner	25	35.2		
	with children	33	46.5		
Diabetes mellitus	yes	25	35.2		
	no	46	64.8		
Hypertension	yes	49	69.0		
	no	22	31.0		
Cardiovascular disease	yes	21	29.6		
	no	50	70.4		
Arthritis	yes	6	8.5		
	no	65	91.5		
Cerebrovascular disease	yes	5	7.0		
	no	66	93.0		
Visual impairment	yes	16	22.5		
	no	55	77.5		
Hearing impairment	yes	9	11.3		
	no	62	88.7		
MMSE score	-	71	-	18.37 ± 6.54	3–30
Tinetti score	-	71	-	11.10 ± 6.66	1–26

Table 2. Correlation between patient age and the Tinetti versus MMSE scores

Age	r	p
MMSE	-0.53	0.001
Tinetti	-0.60	0.001

score for the balance subdimension is 16 points, with a total maximum score of 28 points. The scale has been reported to have a predictive value for the risk of falling and the associated injuries in elderly individuals. Tinetti scores of 18 or less indicate high risk, scores of 19 to 23 indicate moderate risk and scores of 24 or above indicate low risk (1).

**Statistical analysis:** Statistical Package for Social Sciences (SPSS) 16.0 for Windows was used to analyse the data from the 71 elderly patients enrolled in this study. The socio-demographic and health characteristics of the elderly are presented as number, percentage and mean. The independent-samples t-test and one-way analysis of variance were used to evaluate whether the results of the MMSE and Tinetti balance scale differ according to socio-demographic characteristics, and the Pearson's correlation test was used to assess the correlation between age and the MMSE and Tinetti balance scores and the correlation between the MMSE and Tinetti balance scores. The results were evaluated with a confidence interval of 95%, and a p-value of less than 0.05 was considered statistically significant.

Table 3. Comparison of patient lifestyles and history of falling in the previous year versus the Tinetti and MMSE scores

		n	MMSE					Tinetti				
				t*	P	F**	P		t*	P	F**	P
Lifestyle	with children	33	17.46 (5.87)			11.45	<0.01	9.54 (4.43)			11.14	<0.01
	with partner	25	22.68 (6.28)					15.52 (7.35)				
	single	13	15.45 (5.25)					8.36 (5.02)				
History of falling before hospitalization	yes	21	15.00 (5.24)	2.96	<0.01			7.33 (4.51)	3.29	<0.01		
	no	50	19.78 (6.56)					12.68 (6.82)				

\*t test, \*\*ANOVA

## RESULTS

All elderly patients had been hospitalized for hip fracture due to falling. Fifty-nine patients (83.1%) were females with a mean age of  $78.45 \pm 7.37$ , 33 (46.5%) were living with their children, 49 (69%) had hypertension, 25 (35.2%) had DM, 21 (29.6%) had cardiovascular disease, 6 (8.5%) had arthritis, 5 (7%) had cerebrovascular disease, 16 (22.5%) had visual impairment and 9 (12.7%) had hearing impairment. The mean MMSE was  $18.37 \pm 6.54$  and the mean Tinetti score was  $11.10 \pm 6.66$  (Table 1).

There was a moderate negative correlation between age and Tinetti balance scores and MMSE scores, and it was found that as the mean age increased, the MMSE score deteriorated and the risk of falling increased (Table 2).

The mean MMSE score of the elderly patients living alone ( $15.45 \pm 5.25$ ) was statistically significantly lower compared to that of those living with their partners ( $22.68 \pm 6.28$ ) and children ( $17.46 \pm 5.87$ ), and the elderly patients living alone had worse cognitive function ( $p < 0.001$ ) and were at higher risk of falling ( $8.36 \pm 5.02$ ) than those living with their partners ( $15.52 \pm 7.35$ ) and children ( $9.54 \pm 4.43$ ) ( $p < 0.001$ ) (Table 3).

The elderly patients with a history of falling in the one year prior to the study had statistically significantly lower MMSE scores ( $15.00 \pm 5.24$ ) and Tinetti scores ( $7.33 \pm 4.51$ ) but had worse cognitive function ( $p < 0.05$ ) and were at higher risk of falling ( $p < 0.05$ ) compared to the elderly patients without a history of falling in the one year prior to the study (MMSE,  $19.78 \pm 6.56$ ; Tinetti,  $12.68 \pm 6.82$ , respectively) (Table 3).

No statistically significant difference was noted between falling and hypertension, arthritis, DM, visual and hearing impairment and cardiovascular and cerebrovascular diseases.

There was a strong positive correlation between MMSE and Tinetti balance scores, and the risk of falling was found to increase as the MMSE score deteriorated ( $r = 0.798$ ;  $p < 0.001$ ).

## DISCUSSION

In this study, we investigated the relationship between factors such as age, lifestyle, experience of falling in the one year prior to study, disease characteristics and

MMSE and Tinetti balance test scores in elderly patients undergoing hip fracture surgery.

We found that as the mean age increased, the MMSE score deteriorated and the risk of falling increased. Our findings are consistent with those of other studies. For example, McFarlane-Kolb reported that age was an important factor in hospital falls, and the mean age of elderly patients who fell during hospitalization was significantly higher than that of those who experienced no falls during hospitalization (17). In a literature review on fall risk factors in the hospital setting, Evans et al. reported that elderly patients aged 60–65 years were at high risk and those aged 80 years or older were at much higher risk (9). A study conducted in our country reported the incidence of falls to be 33.9% in individuals aged 65 years and older in the one year prior to the study (10).

The incidence of cognitive impairment increases with age. Çuhadar et al. reported cognitive impairment in 27.2% of people aged 60–74 years and in 56% of people aged 75 years or older (8); Karataş and Maral found cognitive impairment in 28.5% of people aged 60–74 years and in 71.7% of those aged 75–94 years (16); and in a study of validation and reliability, Güngen et al. reported lower mean MMSE scores in subjects aged 80 years or older (12).

An investigation of the lifestyles of the elderly patients revealed that those living alone were at a higher risk of falling and had worse cognitive function compared to those living with their partners and children. Cognitive changes due to increasing age lead to difficulty in establishing communication and enhanced the sense of loneliness in elderly people. Similarly, a study of elderly people in Taiwan demonstrated that loneliness increased cognitive function loss in elderly people with cognitive function loss (6), which is also consistent with our findings.

We also found that elderly patients with a history of falling in the one year prior to the study were at a higher risk of falling and had worse cognitive function compared to those who experienced no falls. These results were expected and were consistent with previous studies. For example, Aktaş and Çelik reported that 25% of elderly people with hip fracture had a history of previous falls (2), Karataş and Maral suggested that 49% of elderly people aged 65 years or older had experienced falls previously and that they were at a higher risk of falling (16). Tinetti found that the risk of falling was increased

to 78% among elderly persons with four or more risk factors in the last one year (20), and in a study of risk factors for hospitalized elderly patients, Schwendimann et al. reported that 50% of elderly patients who fell had a previous history of falling (19).

No significant relation were noted between falling and hypertension, arthritis, visual and hearing impairment, DM and cardiovascular and cerebrovascular diseases. However, Çuhadar et al. reported that the rate of falls was higher in elderly people with diabetes compared to those without diabetes (8); Büyüklü demonstrated that falls were more common among elderly people with cardiovascular problems and arthritis (6); and Huang et al. suggested that older adults with arthritis were 9 times and those with previous cardiovascular problems were 23 times more likely to fall (13).

In the present study, the impairment of cognitive function in elderly patients was found to increase the risk of falling. The results of a study by Gleason et al. are similar to our study (11), but Büyüklü and Yeşilbakan reported no relationship between cognitive function and falls (6, ü23).

## CONCLUSION

It would be beneficial to identify elderly patients at a high risk of falling and to involve them in fall prevention programs and to develop exercise programs for balance/mobility problems for elderly patients who underwent hip fracture surgery during the postoperative period.

## Conflicts of interest

None declared.

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## Author's contributions

Study design: ES, IC; data collection and analysis: ES, IC; manuscript writing: ES, IC. This study is a post-graduate thesis.

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## Corresponding author:

İkbal Cavdar BSN MSc PhD, Associate Professor  
Istanbul University, Florence Nightingale,  
Faculty of Nursing  
Surgical Nursing Department  
Abide-i Hurriyet Cad.  
34381 Sisli-Istanbul, Turkey  
E-mail: [ikbal@istanbul.edu.tr](mailto:ikbal@istanbul.edu.tr)