Acta Clin Croat 2020; 59:199-208
doi: 10.20471/acc.2020.59.02.01

Original Scientific Paper

PREVALENCE, ETIOLOGY AND RISK FACTORS FOR FALLS IN NEUROLOGICAL PATIENTS ADMITTED TO THE HOSPITAL IN NORTHERN TURKEY

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SUMMARY – This study was carried out to determine the prevalence of falls, their etiology and risk factors in neurological patients admitted to the hospital in northern Turkey. A cross-sectional, descriptive design was used. Data were collected by survey that identified socio-demographic and clinical features of the subjects, Hendrich II fall risk model and Berg Balance Scale (BBS). Study results revealed approximately one-third of the study patients (33.1%) to have sustained falls before. Concerning the timing of falls, 24.9% of these incidents had occurred within the last year. The most common reason for falling was dizziness (14.3%). The mean score on the Hendrich II fall risk model was 2.7±0.1 for those who had fallen and 2.3±0.1 for those who had not fallen. The respective mean BBS score was 20.7±1.9 and 18.4±1.3. It was found that approximately one-third of neurological patients had fallen before and had restricted their activities due to fear of falls; the great majority of them had a chronic disease and permanently used medicines; and the most important risk factors for falls were advanced age, fear of falls and impaired balance.

Key words: *Balance; Etiology; Fall; Neurology; Prevalence; Prevention; Risk*

Introduction

Falls are common health problems, which might result in significant injuries and complications in health care settings, extend hospitalization, decrease functional capacity of patients and increase health care costs[1]. Giles *et al.* report that falls were the most common critical event reported in inpatients that led to tragic outcomes affecting mortality and morbidity[2]. A previous research found that accidental falls in inpatients caused serious injuries and complications[1]. Falls might be affected by various factors in inpatients. Healey reports that falls among inpatients were caused by a combination of many risk factors involving acute diseases and long-term effects of these diseases, the process of aging, and adverse effects of medication and hospital environment unfamiliar to patients[3]. Lovallo *et al*. report that the majority of patients were exposed to many risk factors and therefore they would probably experience falls, while the nature and prevalence of these factors varied in different hospitalized groups[4]. In another study, it was found that the fall risk profiles of inpatients varied when compared to those in the community; that hospital setting was much different from house setting; and that inpatients were generally more frail due to hospitalization[2].

Previous studies on falls report that neurological patients had a high risk of falling[5], and that falls were more prevalent in neurological services[6,7]. Hunderfund *et al*. found the rate of falls in neurology departments to be 5.69 *per* 1000 patients/day, with neurological inpatients to have a high percentage of falls[8]. Albernaz and Dos Santos Cabral report that 32.5% of their

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Received June 8, 2016, accepted June 20, 2017

study participants had fallen before; 60% of them fell accidentally, 20% fell due to neurological disorder and another 20% due to vestibular disorder, while 40% had neurological disorder and vertigo. They also report that vertigo, imbalance and dizziness were very common in individuals with neurological disorder[9]. Stolze *et al.* found falls in neurological patients to be linked with disorders affecting gait and balance and use of medication[10].

Aim

There is a lack of epidemiological data on falls concerning risk factors and characteristics of neurological patients that affect proneness to falls among neurological patients in northern Turkey. This situation stimulated our embarking upon this study. The present study aimed to determine the prevalence of falls, their etiology and risk factors in neurological patients admitted to the hospital. The research was expected to answer the following questions:

- What is the prevalence of falls, their etiology and risk factors among neurological patients?
- What is the balance status among neurological patients?
- What characteristics of neurological patients affect the fall situation?

Patients and Methods

Study design and sampling method

A cross-sectional, descriptive design was used to determine the prevalence of falls, their etiology and risk factors in neurological patients. It was carried out at a hospital neurology department between May 20, 2011 and April 30, 2012 in Samsun province in northern Turkey. A total of 534 patients were admitted to the department as inpatients during the study. The authors aimed to recruit the entire population of patients admitted to the hospital neurology service due to various neurological problems. However, patients who were not willing to participate in the study (n=24), who failed to complete the questionnaire and did not respond clearly to the questions (n=12), and who were unconscious (n=253) were excluded. The study included 245 patients who gave their consent to take part in the study. The response rate was 45.9%. All subjects were able to answer the questions independently and had no memory problems.

The sample criteria were as follows: age ≥18 years; admission to the neurology department as inpatients; being able to communicate verbally with us; being able to understand the study and provide their informed consent; not taking any psychiatric drugs that would affect his/her mental status; not being too confused to complete the questionnaire; and being able to read and write, a literacy level education. Exclusion criteria were as follows: bedridden and unconscious patients; mental or legal incapacity to provide an informed consent; having communication difficulties (inability to speak) or cognitive impairment; terminal illness; and history of illness or a condition that would affect balance test (e.g., disability).

Procedures

Data were collected *via* a questionnaire prepared by the researchers to determine the patient socio-demographic and clinical specifications, in addition to the Hendrich II fall risk model and the Berg Balance Scale (BBS). The study commenced upon approval granted by the Hospital Scientific Committee. The study followed the principles of the Declaration of Helsinki. We obtained consent from each study participant. This process was carried out in a separate room by the researchers. In the data collection phase, the aims of the research were explained to the patients and their willingness to participate was ensured. Before data collection, the questionnaire was tested in a pilot study on a group of 10 patients. The response and practice time was estimated to 25-30 min.

Instruments

Data were collected using a questionnaire. The first part of the questionnaire contained 30 questions on the patient socio-demographic characteristics, clinical characteristics, and fall characteristics (e.g., status of having fear of falling, the place where they mostly have fear of falling, taking precautions against falling at home, conditions of restricting activities due to fear of falling, condition of experiencing falling incident before, fall time, when the fall occurred, hours of falling, the place where the incident of falling occurred, reasons for falling, states aftermath falling, and number of falling incidents).

Socio-demographic factors collected in the study included age, gender, marital status, education level, family type (large or nuclear), and living arrangements (living with a spouse, family member, or alone). In this study, a city referred to an urban area that was the largest residential area. A town referred to a semi-urban area with an approximate population of 5,000 to 10,000 people. A village was a rural area with an approximate population of 2,000 to 3,000 people. The sample was stratified by age (40-51, 52-63, 64-75, and 76-88 years). Sex was coded as male or female. Marital status was married or single. The study grouped educational levels as literate, elementary school, secondary school, high school, and university.

Clinical characteristics and health behaviors included any chronic illnesses, previous hospitalizations, having a sensory disorder (yes/no), and type of sensory disorders (visual or auditory). Researchers asked about the subject perception of health. Respondents rated their own current health as good, fair, or poor. Data were also collected using the Hendrich II fall risk model and BBS.

Hendrich II Fall Risk Model

The Hendrich II fall risk model is fast to administer and provides determination of the risk of falling[11,12]. The validity and reliability of the Hendrich II fall risk model were tested for Turkish samples by Atay *et al*. in 2009[13]. They assessed data using appropriate statistical methods and found the kappa values obtained for the first seven items on the scale to range from 0.77 to 1.00. The Spearman's rho value obtained for the eighth item, related to standing up and walking, was 0.91. The reliability of the Turkish version of the Hendrich II fall risk model was found to be acceptably high in their study[13]. In our study, the alpha coefficient for patients was 0.79.

Berg Balance Scale

Balance was measured using the BBS[14,15]. The validity and reliability of the BBS were tested for Turkish samples by Sahin *et al*. in 2008. In their research, internal consistency (Cronbach's alpha) of the BBS total score was calculated as 0.93[16]. In our study, the alpha coefficient for patients was 0.85.

Data analysis

On data evaluation, percentage calculation, one-way ANOVA, Student's t-test, Pearson correlation analysis, and logistic regression analysis were used.

Results

Sample characteristics

Study results revealed that 37.6% of the subjects were 64-75 years of age; 53.9% were female and 46.1% were male; 86.1% were married; 58.8% were literate; 62.0% had income less than expenses; 90.2% did not work; 70.2% had a nuclear family; 97.6% had social security; 35.5% lived with a spouse; and 49.8% lived in a city (Table 1).

Clinical characteristics

In this study, 75.5% of patients reported that their health condition was fair; 89.8% had chronic disease; 20.4% had diabetes: 46.5% had hypertension disease; 83.3% had been previously hospitalized; 29.4% had a sensory disorder: 21.2% had a visual disorder; and 89.8% used maintenance medicines for chronic diseases (Table 2).

Falling status among neurological patients

Study results showed that 32.2% of study patients had a fear of falling, mostly while having bath; 72.2% took precautions against falling at home; 14.3% restricted their activities because they were afraid of falling; and 33.1% had fallen during the previous three years. For the falls, 24.9% of the falling incidents occurred in the last year, 21.6% of the falling incidents occurred at daytime and 12.2% occurred in the afternoon. The most common reason for falling was dizziness (14.3%) and 7.3% had a lesion after falling (Table 3).

Balance status and falling risk among neurological patients

In the present study, 11.4% of neurological patients had a high risk of falling. The mean score on the Hendrich II fall risk model was 2.4±0.1. The mean score on the Hendrich II fall risk model was 2.7±0.1 for those who had fallen and 2.3±0.1 for those who had not fallen, yielding no statistically significant difference between the two groups (t=1.590, p=0.116). The mean score on the BBS among all neurological patients was 19.2±1.1, with 89.0% scoring ≤45 points. The mean BBS score was 20.7±1.9 for those who had fallen and 18.4±1.3 for those who had not fallen, thus yielding no statistically significant difference between the two groups (t=1.027, p=0.308) (Fig. 1).

Table 1. Demographic characteristics of patients (N=245)

Characteristic	n	%
Age group (years)	66.5±0.9	
40-51	28	11.4
52-63	48	19.6
64-75	92	37.6
76-88	77	31.4
Gender		
Female	132	53.9
Male	113	46.1
Marital status		
Married	211	86.1
Single	34	13.9
Education		
Literate	144	58.8
Primary school	60	24.5
Secondary school	14	5.7
High school	21	8.6
University	6	2.4
Socioeconomic status		
Income less than expenses	152	62.0
Income equal to expenses	85	34.7
Income more than expenses	8	3.3
Working status		
Yes	24	9.8
No	221	90.2
Family type		
Large	73	29.8
Nucleus	172	70.2
Social security		
Present	239	97.6
Absent	6	2.4
Living with		
Spouse	87	35.5
Spouse and children	73	29.8
Children	72	29.4
No one	13	5.3
Place of residence		
City	122	49.8
Town	63	25.7
Village	60	24.5

Table 2. Clinical characteristics of patients (N=245)

Characteristic	n	%
Type of neurological disorder		
Cerebrovascular disease	168	68.6
Vertigo	22	9.0
Epilepsy	11	4.5
Headache	9	3.7
Alzheimer's disease	9	3.7
Multiple sclerosis	7	2.8
Dementia	16	6.5
Parkinson's disease	3	1.2
Perceived health		
Good	33	13.5
Fair	185	75.5
Poor	27	11.0
Chronic disease condition		
Yes	220	89.8
No	25	10.2
***Has chronic illness**		
Hypertension	114	46.5
Diabetes	50	20.4
Coronary arterial disease	17	6.9
Renal failure	3	1.2
Asthma	8	3.3
Chronic obstructive pulmonary disease	12	4.9
Others	8	3.3
Previous hospitalization		
Yes	204	83.3
No	41	16.7
Status of heaving sensory disorder		
Yes	72	29.4
No	173	70.6
***Sensory disorders (n=72)**		
Visual	52	21.2
Auditory	11	4.5
Visual-auditory	9	3.7
Status of using continuous medicine		
Yes	220	89.8
No	25	10.2

*More than one answer given.

Table 3. Distribution of patient features according to falling incidents (N=245)

Characteristic	n	%
Having fear of falling		
Yes	79	32.2
No	166	67.8
***The place where patients mostly had fear of falling** (n=79)		
While going downstairs	27	11.0
While having bath	39	15.9
Other	18	7.3
Taking precaution against falling at home		
Yes	177	72.2
No	68	27.8
***Precautions taken against falling at home** (n=177)		
Grab irons on the stairs	153	62.4
Grab irons in the bathroom and toilet	3	1.2
Smooth floor surface	21	8.6
Anti-skid matting in the bathroom	60	24.5
Restricting activities due to fear of falling		
Yes	35	14.3
No	210	85.7
Having experienced falling incident before		
Yes	81	33.1
No	164	66.9
Fall time (n=81)		
Night	28	11.4
Daytime	53	21.6
When the fall occurred? (n=81)		
Last year	61	24.9
1 year ago	4	1.6
2 years ago	8	3.3
3 years ago	8	3.2
***Hours of falling** (n=81)		
Getting up in the morning	5	2.0
Before noon	26	10.6
Afternoon	30	12.2
Evening	19	7.8
At night	10	4.1
***The place where the falling incident occurred** (n=81)		
On the street	15	6.1
In the room	48	19.6
In the bathroom	13	5.3
In the toilet	12	4.9
On the stairs at home	3	1.2
On the stairs outside home	4	1.6
***Reason for falling** (n=81)		
Dizziness	35	14.3
Stumbling	13	5.3
Imbalance	17	6.9
Gait and balance disorder	15	6.1
Wet floor	4	1.6
Movement and strength problems	7	2.8
State aftermath falling (n=81)		
Lesion	18	7.3
Laceration	4	1.6
Fracture	6	2.4
Hematoma	4	1.6
Nothing	49	20.0
Average of falling incident	1.4±.1	

*More than one answer given.

Logistic regression analysis was performed to determine some risk factors affecting falls in neurological patients. Logistic regression analysis showed that the model accurately estimated the risk of falls at 88.2% and each increase in age unit increased the risk of falls (p=0.000); the residence unit where the patients lived had a significant impact on the risk of falls, and compared to the patients living in villages, those living in town districts had a 7.9-fold higher risk of falling; the state of health perception also affected falls (p=0.001); compared to the patients with negative perception of health, the risk of falls was 0.09 times higher in those

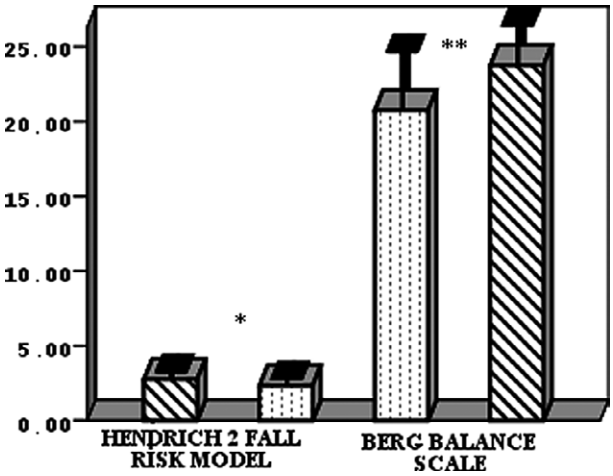

*Fig. 1. Distribution of total score of Hendrich II fall risk model and Berg balance scale of patients with and without falls (*t=1.590, p=0.116; **t=1.027, p=0.308).*

with good health perception; it was 0.08 times higher in those with moderate level of health perception and 0.18 times higher in those with fear of falling (p=0.013). Logistic regression analysis showed that the model accurately estimated balance risk in 89.0% and that like in falls, each increase in age unit affected balance and increased the risk of falls (p=0.000) (Table 4).

Discussion

Although it has been reported that falls in inpatients cause serious injuries and complications[1], it was found that the literature contained a limited number of research on the prevalence of risk factors and diagnosis of falls[8,10,17]. This study will contribute to understanding the prevalence, etiology and risk factors in neurological patients in northern Turkey and help develop appropriate guidelines to reduce patient falls.

In the present study, it was found that 11.4% of neurological patients had a high risk of falling. Lovallo *et al.* report that 29.69% of patients had the risk of falling; 70.31% had no risk of falling; neurology department ranked third in the prevalence of falls (18.6%) following oncology (35.6%) and rehabilitation (20.3%) departments[4]. Other studies found that neurological patients had a risk of falling[8]; when compared to other services, the rate of fall cases was higher in neurology services[5-7]. As indicated in the literature, arrangements in interior structure of hospitals[5] and implementation of programs to prevent falls and injuries is of great importance to reduce falls among neurological patients[5,6].

In the present study, the majority (89.8%) of patients had a chronic disease, particularly hypertension and diabetes, and they were taking medication for their chronic diseases regularly. Similarly, Özden *et al.* report that patients had chronic diseases, mainly hypertension, coronary artery disease, diabetes mellitus (83.7%, 41.8% and 28.3%, respectively) and that almost all of them (94.6%) used medication[18]. Stolze *et al.* report that antidepressants, antihypertensives, diuretics and digitalis are risk factors for falls[10]. Results of the present study suggest that, considering that the majority of neurological patients had chronic diseases and used medication for these diseases, these patients should be closely monitored for the risk of falling and adverse effects of medicines.

It was found that approximately one-third of the study patients (33.1%) had fallen during the previous three years. Previous studies determining falls in neurological patients report that fall prevalence varied between 7.2% and 89.2%[1,9,10,18-20]. On the other hand, comparison of our findings with those of other studies with similar research methodology showed the prevalence of falls in neurological patients to be higher in other studies[10,18,19]; however, in some other studies, the prevalence of falls was lower as compared with our study[9,20].

We found that falls occurred mostly in rooms (19.6%) and that the most significant cause of falls was dizziness (14.3%). On the other hand, other studies found that falls generally occurred inside houses[10,18,19], outside[10], in other buildings[10], in the street[18], in patient bathroom[7], toilet[18], corridor[18]; and that they had fallen due to wet floor[10], poor lighting[10], inadequate shoes[10], walking bare foot[10], slippery ground[7,10], posture and gait disorders[10], malfunction of wheelchair[18], fainting[7], and vertigo[9]. Similar to these findings, previous studies report that falls occurred mostly in patient rooms[1,6,7,18] and that the most important causes of falling were loss of balance and dizziness[7,9,18]. Albernaz and Dos Santos Cabral report that neurological patients experienced loss of balance and dizziness very often, therefore falls were frequent among them[9].

Table 4. Some risk factors affecting the status of falls and balance and odds ratio

Risk factor	Hendrich II fall risk model		Berg balance scale	
	Odds ratio (95% confidence interval)	p	Odds ratio (95% confidence interval)	p
Age	1.111 (1.052-1.172)	0.000	0.922 (0.887-0.958)	0.000
Gender				
Female	0.450 (0.175-1.157)	0.097	0.831 (0.331-2.087)	0.694
Male	2.00		2.00	
Place of residence		0.015		
City	2.917 (0.761-11.190)	0.119	3.895 (0.772-19.653)	0.100
Town	7.972 (1.868-34.027)	0.005	2.342 (0.382-14.378)	0.358
Village	3.00		3.00	
Perceived health		0.001		
Good	0.096 (0.014-0.664)	0.018	3.421 (0.560-20.886)	0.183
Fair	0.086 (0.024-0.313)	0.000	0.883 (0.157-4.968)	0.888
Poor	3.00		3.00	
Status of having fear of falling				
Yes	0.189 (0.051-0.700)	0.013	0.821 (0.296-2.282)	0.706
No	2.00		2.00	

In the present study, lesion, fracture, laceration and hematoma occurred in patients after falling (7.3%, 2.4%, 1.6% and 1.6%, respectively). Although types and rates of injuries after falling showed variation in other studies, fractures[10,18], contusions[6,10], soft tissue damage[10], trauma[6], abrasion[6], laceration[6,18], head injury[6,18] and chest trauma[18] occurred after falling.

In the present study, the most important risk factors for falls were age, status of balance and fear of falling. In another study that determined the prevalence, etiology and risk factors for falls it was found that factors such as old age[8,10,18,19], stroke[21], dementia[21], Parkinson's disease[21], peripheral neuropathy[21], depression[19], vertigo and dizziness[8,9], posture disorders[10], gait disorders[8,10,18,19,21], balance disorders[8-10,18,19,21], history of the last fall[8,18,21], fear of falls[10], use of psychotropic medication[8], antidepressant treatment[10], neuroepileptics[10], cardiovascular medicines[10], use of antihypertensive medicines[18], change in the level of consciousness[18], adverse environmental factors in patient house[10], use of walking aids[10,21], lower extremity weakness[21], muscle weakness[8], use of inappropriate walking aid[19], sensory losses[21], problems in bowel and bladder movements[8], and significant loss of vision[8,18,21] increased the risk of falls in neurological patients. Although the prevalence, etiology and risk factors in neurological patients varied, we believe that this variation might have resulted from research methodology, socio-demographic and clinical characteristics of the study groups.

We found that patients feared of falls mostly while taking bath; they restricted their movements due to this fear and the rate of falls was increased 0.18 times in those that had fear of falls. In previous studies, 10.9% of falls occurred in the bathroom[7]; fear of falls was an intrinsic risk factor for falls[10]; and fear of falls might cause reluctance in daily life activities of patients[1].

In the present study, it was found that falls mostly occurred during the day and in the afternoon. On the other hand, Hitcho *et al.* report that 58.5% of falls oc-

curred between 7 p.m. and 6 a.m.[7]. The fact that falls occurred during the day might result from meeting personal care needs when they are more active. The fact that previous studies found that falls mostly occurred at night might result from problems of patients due to bowel and bladder movements[8], or they wanted to use bathroom. Lovallo *et al*. report that 32.2% of falls occurred at night and 34% occurred on their way to bathroom; accordingly, going to toilette was a significant risk factor for falls[4].

Logistic regression analysis performed to determine some risk factors affecting falls of patients revealed the risk of falls to have increased in patients who felt fear of falls and at each age unit increase. Similar to our findings, previous studies have reported that age[10,18,22] and fear of falls[10] were important risk factors affecting falls. Giles *et al.* conducted logistic regression analysis and report that confusion, incontinence, mediation, movement and sleep disorders were significant risk factors affecting patient safety among inpatients[2].

It was found that like in falls, each unit increase of age affected status of balance and increased the risk of falls. Some of the studies report that loss of balance[8-10,18,21], vertigo[23] and gait disorder were the most important risk factors in neurological patients, while many risk factors for falls such as gait and balance problems can be modified[24]. Morse reports that due to iatrogenic nature of hospital settings, they are risky places for patients in terms of falls, injuries and deaths, and that health care professionals are responsible for taking protective and preventive measures to eliminate and reduce these risks[25]. As indicated in the literature, considering each etiologic target in hospitals, it is of great importance to understand the use of fall preventive principles and to implement them comprehensively and systematically.

Comparison of the risk profiles of inpatients with those in the society showed variations; hospital environment was found to be much different from home environment, inpatients were generally more frail due to hospitalization, and therefore the measures to reduce falls in hospitalized subjects should be different from those in home setting[2]. In this context, since the present study was carried out in neurological inpatients, it cannot be generalized to different neurological patients in the community. For this reason, future studies should be planned to include neurological patients in the community, as indicated in the literature[17]; studies should be conducted in individuals with special neurological conditions that might affect gait, movement and balance.

Conclusions

It was found that approximately one-third of neurological patients had fallen before and they restricted their activities due to fear of falls; in addition, the great majority of them had a chronic disease and permanently used medicines; the most important risk factors for falls were age, fear of falls and balance disorder. Based on these findings, health care professionals are suggested to diagnose fall risk factors with comprehensive assessment (including chronic diseases, medicines, functional condition, house safety, etc.) to reduce the risk of falls, upgrade patient safety and increase mobility of neurological patients. Nurses are recommended to diagnose the risk of falls in all inpatients and to make assessments using fast, easy and practical monitoring tools to reduce and prevent falls in neurological patients. In addition, as indicated in the literature, we suggest the use of exercise programs for balance training[17]. On the other hand, it is of great importance to organize training programs for patients, health care providers and health care professionals to prevent falls.

Acknowledgment

We would like to thank the elderly for taking part in this study.

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Sažetak

UČESTALOST PADOVA, NJIHOVA ETIOLOGIJA I ČIMBENICI RIZIKA KOD NEUROLOŠKIH BOLESNIKA PRIMLJENIH U BOLNICU U SJEVERNOJ TURSKOJ

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Proveli smo presječno deskriptivno istraživanje kako bismo utvrdili učestalost padova, njihovu etiologiju i rizične čimbenike kod neuroloških bolesnika primljenih u bolnicu u sjevernoj Turskoj. Prikupljeni su podaci kojima su utvrđene sociodemografske i kliničke karakteristike ispitanika, model rizika za pad Hendrich II. i *Berg balance scale* (BBS). Rezultati su pokazali da je otprilike jedna trećina bolesnika uključenih u istraživanje (33,1%) već prije doživjela pad, pri čemu se 24,9% takvih incidenata dogodilo tijekom protekle godine. Omaglica je bila najčešći razlog za pad (14,3%). Srednji zbir u modelu rizika za pad Hendrich II. bio je 2,7±0,1 za bolesnike koji su doživjeli pad i 2,3±0,1 za bolesnike koji nisu doživjeli pad. Srednji zbir BBS bio je 20,7±1,9 odnosno 18,4±1,3 za bolesnike koji su doživjeli odnosno nisu doživjeli pad. Otprilike jedna trećina neuroloških bolesnika već je prije doživjela pad pa su ograničili svoje aktivnosti zbog straha od pada. Velika većina bolesnika imala je kronične bolesti i trajno su uzimali lijekove. Najvažniji čimbenici rizika za pad bili su poodmakla dob, strah od pada i poremećaj ravnoteže.

Ključne riječi: *Ravnoteža; Etiologija; Pad; Neurologija; Učestalost; Prevencija; Rizik*