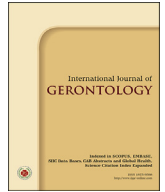


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Original Article

Factors Associated With Multiple Falls Among Elderly Patients Admitted to Emergency Department

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SUMMARY

Background: Fall related injuries constitute a significant part of emergency department admissions of geriatric patients. Recurrent falls are also not uncommon. The aim of this study is to evaluate the factors that might be related with multiple falls among the elderly patients admitted to emergency department. **Methods:** The study was conducted between 1st May 2014 and 31 October 2014 at a tertiary education and research hospital in Istanbul, Turkey. All the patients over 65 years who admitted to emergency department due to falls were included. Patients and/or their relatives were asked to answer the questions searching for possible factors that may interfere with their multiple falls.**Results:** During the study period 308 patients over 65 years old admitted to emergency department. 51% were between 65 and 79 years old and 49% were >80 years old. The women constituted the 70.1% of the cases. The majority of the cases described the mechanism of injury as stumbling and fall (72.4%). Factors related with multiple falls were as follows: being between 65 and 79 ages, being physically active before the fall event, having chronic cardiovascular and neurologic diseases and being on benzodiazepine and SSRI medication.**Conclusion:** Physically active and relatively younger elderly fall more frequently. As the most commonly described mechanism was stumbling and fall, the importance of environmental risk factors is emphasized. Patients with cardiovascular and neurological diseases should be further evaluated for increased fall risk and indications of benzodiazepines and SSRI's in elderly people should be well evaluated.Copyright © 2017, Taiwan Society of Geriatric Emergency & Critical Care Medicine. Published by Elsevier Taiwan LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Fall related injuries constitute a significant part of emergency department (ED) admissions of geriatric patients. According to Centers for Disease Control reports, 2.5 million nonfatal falls among older adults were treated in EDs and more than 734,000 of these patients were hospitalized in 2013.¹ Recurrent falls are also not uncommon. One-third of individuals over 65 years falls at least once a year and it has been shown that this ratio reached 50% over 80 years.^{2,3} Injuries due to falls in elderly generally result in minor soft tissue injuries probably due to low energy of the exposed trauma. Some authors reported that only 5–10% of all falls resulted in major injuries like fracture, head trauma, major

lacerations.^{4,5} However falls are generally related with the reduced functionality.

Studies have shown that, after the first fall, decline in functional capacity of elderly, causing them to enter a vicious circle. The possibility of nursing home facility placement and the frequency of hospital admissions have increased after falls among elderly people. The risk of recurrent falls has also increased after the first fall.^{2,6,7} Mortality rate due to the impact of injury is low. However the complications related with the falls increase the risk of death.^{8,9}

“Fear of Falling” or “Post-fall Syndrome” which is generally categorized as a post-traumatic stress syndrome is another psychosocial problem that has to be faced by most of the elder people. It is characterized by high levels of anxiety related to walking.^{10,11} On the other hand less than half talk to their healthcare providers about their episode of fall.¹²

The most important point in the prevention of falls is the identification of environmental and personal factors that give rise

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to falls and to take precautions against these risk factors. Several studies showed that the most important consideration is the history of previous falls which places the patient at increased risk of future falls.^{13–15} The aim of this study is to evaluate the incidence of multiple falls and the factors that might be related with multiple falls among the elderly patients admitted to emergency department due to a fall event.

2. Methods

This study is conducted between 1st May 2014 and 31 October 2014 at an ED of a tertiary education and research hospital in Istanbul, Turkey which is visited by more than 20,000 patients monthly. All the patients over 65 years who admitted to ED due to falls during the study period were included. Patients and/or their relatives were asked to answer the questions searching for possible factors that might interfere with their fall events. Besides the demographic data, people were asked about their education attainment, monthly incomes, physical status before the injury, living places, and the number of previous fall events in the last 12 months. And if they described even one episode of fall in the last 1 year other than this admission, we accepted it as multiple falls. The mechanism of injury and the places of falls were also noted.

The medical data in the ED were investigated about chronic diseases and medications at the time of admission. The type of injury, need for an operation, need for hospitalization and mortality rate in the ED after the injury, were recorded. Co-existing medical conditions were also noted. The institutional review board of the hospital approved the study protocol.

The data were analyzed by using NCSS (Number Cruncher Statistical System) 2007 & PASS (Power Analysis and Sample Size) 2008 Statistical Software (Utah, USA) program. For the analyses, besides descriptive statistical methods (frequency, percentage, minimum, maximum, mean and standard deviation), Pearson's Chi-square test, Fisher-Freeman-Halton exact test and Fisher's exact test were used for the comparisons of qualitative data. Backward stepwise logistic regression analysis model was applied for possible independent factors. Statistical significance were assumed for $p < 0.05$ and $p < 0.01$.

3. Results

During the study period 308 patients over 65 years old admitted to ED because of a fall. The mean age was 78.52 ± 7.63 . 51% were between 65 and 79 years old ($n = 157$) and 49% ($n = 151$) were ≥ 80 years old. The women constituted the 70.1% ($n = 216$) of the cases. Half of the cases had less than 1000 TRY monthly income that can be considered very low. In terms of education attainment, 24.7% ($n = 76$) were illiterate, and only 8.8% ($n = 27$) were graduated from university. The study group was mostly expressed that they were living with a first degree relative (73.1%, $n = 225$). Nearly 17% of the cases ($n = 52$) were living alone (Table 1).

Comparisons of descriptive data showed that the lower the monthly income, the rate of staying in a nursing home is increasing ($p = 0.005$). Patients with monthly income of >2000 TRY mostly live alone ($p = 0.034$). When the educational attainment, monthly income and living place were examined as a risk factor for multiple falls, there was not any significant relation. The p values were 0.599, 0.704 and 0.985 respectively.

Multiple falls were also not related with cender ($p = 0.780$). However we have found that patients over 80 years old experienced multiple falls more than the patients between 65 and 79 years old ($p = 0.018$).

In terms of physical status before the fall episode, 62.7% ($n = 193$) of the patients were physically active, 8.1% ($n = 25$) were

Table 1
Descriptive evaluation of the patients.

		n	%
Age (year)	65–79	157	51.0
	≥ 80	151	49.0
Gender	Female	216	70.1
	Male	92	29.9
Monthly income	<1000 TRY	156	50.6
	1000–2000 TRY	131	42.5
	>2000 TRY	21	6.8
Educational attainment	Illiterate	76	24.7
	Literate	21	6.8
	Elementary school	115	37.3
	Mid-school	32	10.4
	High school	37	12.0
Living place	University	27	8.8
	Alone	52	16.9
	First degree relative	225	73.1
	Care-giver	10	3.2
	Nursing home	21	6.8

TRY, Turkish Lira.

able to walk with assistance, 26.3% ($n = 81$) were able to walk with devices and the rest 2.9% ($n = 9$) were immobile. There was significant difference between the multiple falls and physical status ($p = 0.001$). This difference was resulted from the physically active group (Table 2).

When examining the patients' past medical histories, cardiovascular and metabolic diseases were the most commonly observed chronic diseases. There were patients with possible psychological diseases. However none of them was examined by a psychiatrist and the diagnoses were accepted as unclear, therefore not listed as a risk factor in our group. The most commonly used drugs among the study group were anti-hypertensive, anti-diabetics and selective serotonin reuptake inhibitors (SSRI) respectively (Table 3).

The most common injuries were minor head traumas, soft tissue injuries, and hip-femur fractures. The type of injuries and the final destinations were summarized in Table 4.

When the places of fall and the mechanisms of fall were compared there was not any significant difference ($p = 0.636$). Similarly comparisons of the mechanism of falls and the final destination of the patient were statistically insignificant ($p = 0.095$). However discharge from the ED rates were significantly high in physically active patients ($p = 0.006$). Physically active patients and the ones who were able to walk with devices had more operation rates. p values were 0.007 and 0.005 respectively.

Table 2
Fall related distributions.

		n	%
Physical status before the fall event	Physically active	193	62.7
	Walk with aid	25	8.1
	Immobile	9	2.9
	Walk with device	81	26.3
Mechanism	Stumbling and fall	223	72.4
	Vertigo	51	16.6
	Syncope	24	7.8
	Acute stroke	5	1.6
	Fall from bed	5	1.6
Number of falls in 12 months	1 fall	167	54.2
	2 fall	54	17.5
	3 fall	20	6.5
	>3 falls	67	21.8
	Patients with multiple falls	141	45.8
Place of fall	Room	153	49.7
	Bathroom	58	18.8
	Stairs	21	6.8
	Outside the house	76	24.7

Table 3
Past medical history and medications.

		n	%
Chronic diseases	Cardiovascular	230	74.7
	Musculoskeletal	46	14.9
	Eye	21	6.8
	Metabolic	131	42.5
	Neurological	84	27.3
	Pulmonary diseases	26	8.4
Drugs	SSRI	55	17.9
	TCA	4	1.3
	Neuroleptics	20	6.5
	Benzodiazepines	7	2.3
	Anti-epileptics	12	3.9
	Class1anti-arythmics	77	25.0
	Anti-hypertensive	220	71.4
	Digitalis	6	1.9
	Anti-diabetics	78	25.3
	Drugs for osteoporosis	40	13.0
	Non steroid anti-inflammatory drugs	3	1.0
	Eye drops	16	5.2

Table 4
Type of injury and final destinations.

		n	%
Injury	No injury	31	10.1
	Minor head trauma	77	25.0
	Major head trauma	3	1.0
	Soft tissue injury	70	22.7
	Hip/femur fracture	61	19.8
	Lower extremity fracture/dislocation	9	2.9
	Upper extremity fracture/dislocation	41	13.3
	Thorax trauma	9	2.9
	Vertebral fracture	7	2.3
	Result	Hospitalization	76
Discharge form ED		230	74.7
Exitus		2	0.6
Operation		59	19.2

When the factors that were considered to be associated with the multiple falls were examined, the educational attainment, monthly income and the living places were found statistically irrelevant with multiple falls. *p* values were 0.599, 0.704 and 0.985 respectively. Patients with cardiovascular and neurological diseases were found to have experienced multiple falls more ($p = 0.048$ and $p = 0.049$). Benzodiazepines and the SSRI use had significant relationship with multiple falls ($p = 0.05$ and $p = 0.042$) (Table 5).

The factors, which were found to have statistically significant effect on multiple falls in univariate analysis (age, physical status before the fall event, cardiovascular and neurologic diseases, SSRI and benzodiazepine use), were also assessed with Backward stepwise logistic regression analysis. The model was significant ($p < 0.001$) and Nagelkerke R square level was 0.098. Explanatory coefficient was at a good level (73.6%). "Physical status before fall event" had a significant effect on the model ($p < 0.05$). "Walk with assistance" had 4.027 fold, "being immobile" had 3.576, and "walk with devices" had 2.397 fold impacts on multiple falls. Although the effect of "benzodiazepine use" to the model was insignificant ($p > 0.05$), it could remain in the model and showed 5.191 fold increasing effect to multiple falls (Table 6).

4. Discussion

Falls are a significant health problem for elderly people. There are intrinsic and extrinsic risk factors. Taking into consideration the needs of the elderly, most of these factors are probably be modified to prevent another fall event. We aimed to search primarily the

factors that might be related with recurrent falls with this study. The percentage of patients describing multiple falls in the last 12 months was 45.8% ($n = 141$).

In our study group the majority of the patients were female, however being a woman was not associated with multiple falls. Nearly half of our patients were over 80 years old and older age is a significant risk for multiple falls. Our results consistent with the epidemiologic results in recent studies.¹⁻³ Most of our patients expressed, that they had low or middle income and they were living with their first degree relatives as a traditional way of life in Turkish society. The educational attainments of the group were variable. None of these descriptive features were found related with multiple falls. There are different results about this aspect in the literature probably because of the cultural differences. For example Choi and friends also did not find any relation between education attainments, income level and residence type with fall risk among Korean elderly.¹⁶ Also Alamgir and friends found no relation in the study which was conducted in Texas.¹⁷ However Shi and friends from China and Siqueira and colleagues from Brazil showed some significant relations.^{18,19}

Most of our patients (62.7%) were physically active before the fall event. Using devices for gait assistance were found to be related with falls in elderly in some previous studies.^{20,21} However recently, Gell and colleagues investigated the frequency of mobility device use in elderly and its relation with recurrent falls in a large group. They found that recurrent falls were not associated with mobility device use.²² Our results support the Gell's study. This is probably because of the patients who were able to walk with assistance of their caregiver. According to our results, there were a considerable number of patients (26.3%) who had walking difficulties and not using devices. This group of patients probably did not seek for a medical advice to use such devices or they might have refused to use them. But it was obvious that they need help to walk. Thus logistic regression analysis results showed that physical status before fall event had a significant effect on multiple falls.

The majority of the patients described simple mechanisms mostly the stumbling and fall in their living places. This may be associated with the elderly people spent most of their times at home. When the places of fall and the mechanisms of fall were compared there was not any significant difference. Our results supported the importance of taking precautions for the environmental risks in the elderly's living places.^{23,24}

Despite the fragile nature of the elderly body, the resulting injuries did not require hospitalization and invasive procedures in most of the cases. Similarly the mortality rates were very low, probably due to low-energy accidents. The most commonly observed injuries were minor head traumas, soft tissue injuries and hip-femur fractures respectively. 10% of the patients did not have any injury except minor bruises and abrasions. The frequency of the pathologies due to falls and hospitalization rates showed similarities with the literature.^{4,5,25}

We have also investigated the relationship between the chronic diseases, which were accepted as risk factors in previous studies.^{2,5,18} In our study group the most commonly observed diseases were cardiovascular diseases and metabolic diseases follow them. However compared with multiple falls, cardiovascular and neurologic diseases were significantly related with recurrent falls. We thought that this finding should not be assessed solely because chronic diseases and drug usage are intricately intertwined conditions. So we searched also the relationship of the drugs with recurrent falls. The antihypertensive drugs were the most commonly used drug and the anti-diabetics took the second place as we expected. Despite the high frequency of these drugs usage they did not have any effect on the fall recurrence in our study group. Most recently Marcum and friends also concluded the same

Table 5
Factors that were considered to be related with multiple falls.

		1 fall	>1 fall	p
		n (%)	n (%)	
Age (years)	65–79	96 (60.8)	62 (39.2)	0.018
	≥80	71 (47.3)	79 (52.7)	
Sex	Female	116 (53.7)	100 (46.3)	0.780
	Male	51 (55.4)	41 (44.6)	
Physical status before fall event	Active	123 (63.7)	70 (36.3)	0.001
	Walk with assistance	7 (28.0)	18 (72.0)	
	Immobile	3 (33.3)	6 (66.7)	
Educational attainment	Walk with devices	34 (42.0)	47 (58.0)	0.599
	Illiterate	42 (55.3)	34 (44.7)	
	Literate	11 (52.4)	10 (47.6)	
	Elementary school	59 (51.3)	56 (48.7)	
	Mid-school	22 (68.8)	10 (31.2)	
Monthly income	High school	18 (48.6)	19 (51.4)	0.704
	University	15 (55.6)	12 (44.4)	
	<1000 TRY	82 (52.6)	74 (47.4)	
	1000–2000 TRY	72 (55.0)	59 (45.0)	
Living place	>2000 TRY	13 (61.9)	8 (38.1)	0.985
	Alone	29 (55.8)	23 (44.2)	
	First degree relative	122 (54.2)	103 (45.8)	
Chronic diseases	Care-giver	5 (50.0)	5 (50.0)	0.048
	Nursing Home	11 (52.4)	10 (47.6)	
	Cardiovascular	117 (50.9)	113 (49.1)	
	Musculoskeletal	27 (58.7)	19 (41.3)	
	Eye	13 (61.9)	8 (38.1)	
Drugs	Metabolic	66 (50.4)	65 (49.6)	0.245
	Neurological	38 (45.2)	46 (54.8)	0.049
	Pulmonary disease	11 (42.3)	15 (57.7)	0.203
	SSRI	23 (13.8)	32 (22.7)	0.042
	TCA	3 (1.8)	1 (0.7)	0.628
	Neuroleptics	9 (5.4)	11 (7.8)	0.533
	Benzodiazepines	1 (0.6)	6 (4.3)	0.050
	Anti-epileptics	5 (3.0)	7 (5.0)	0.552
	Class 1 anti-arythmics	35 (21.0)	42 (29.8)	0.075
	Anti-hypertensive	112 (67.1)	108 (76.6)	0.065
Digitalis	2 (1.2)	4 (2.8)	0.418	
Anti-diabetics	38 (22.9)	40 (28.4)	0.272	
Drugs for osteoporosis	24 (14.5)	16 (11.4)	0.540	
Nonsteroid anti-inflammatory drugs	0 (0)	3 (2.1)	0.095	
Eye drops	10 (6.0)	6 (4.3)	0.671	

Pearson's Chi-square test, Fisher's Exact test and Continuity (Yate's) correction; *p < 0.05.

TRY, Turkish Lira.

Table 6
Backward stepwise logistic regression analysis of multiple fall risks.

	p	OR	95.0% CI for OR	
			Lower	Upper
Step 5(a) Active	0.001			
Walk with assistance	0.004	4.027	1.579	10.271
Immobile	0.078	3.576	0.867	14.748
Walk with devices	0.001	2.397	1.408	4.081
Benzodiazepines	0.140	5.191	0.583	46.242

OR: Odds Ratio; CI: Confidence Interval.

result in their research.²⁶ However some researchers found some degree of relation with some other drugs such as central nervous system acting drugs, non-steroid anti-inflammatory drugs, anti-Alzheimer's drugs, Calcium antagonists, diuretics, α -blockers.^{27,28} In our study group specifically SSRI's and the benzodiazepines were the two drugs that we found a statistically significant relation with multiple falls in univariate analyses. Although the logistic regression analysis showed that the effect of benzodiazepines to the model was insignificant, it remained in the model and showed 5.191 fold increasing effect to multiple falls. On the other hand

SSRI's was not remained in the model. However according to our results we thought that it is possible to say that physicians should examine the elderly people in terms of fall risk before prescribing benzodiazepines and SSRI's.

4.1. Conclusion

According to our results physically active and relatively younger elderly fall more frequently. As the most commonly described mechanism was stumbling and fall, the importance of environmental risk factors is emphasized. Patients with cardiovascular and neurological diseases should be further evaluated for increased fall risk and indications of benzodiazepines and SSRI's in elderly people should be well evaluated. However with large study groups different results may be obtained.

5. Limitations

This study reflects a local data therefore there might be different results with much larger groups. We did not categorize the patients as living in a nursing home or not because of the low number of nursing home resident patients in our group. So we could not evaluate the possible effect of living in a nursing home as it was found a major risk factor in previous reports. There were patients with possible psychological diseases. However none of them was examined by a psychiatrist and the diagnoses were accepted as unclear. But considerable number of patients was using antidepressants and neuroleptics in our group. Psychiatric diseases might be a risk factor for multiple falls. Also in emergency room conditions we could not asked in detail about insomnia that might be possible risk factor.

Conflict of interest

None.

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