Original Article

Relationship between Falling and Chronic Diseases in the Elderly: A Study Derived from Amirkola Health and Ageing Project

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Abstract

Background: Chronic diseases and falling are important health issues among elderly people since they are able to reduce the quality of their lives.
Objectives: The present study aimed to investigate the relationship between chronic diseases and falling in the elderly.
Methods: The present cross-sectional study was derived from the first phase of the Amirkola Health and Ageing Project (AHAP) that had been performed on all elderly people aged 60 and above in Amirkola city in the northern part of Iran. The demographic characteristics, including chronic diseases, were collected through self-report questionnaires and observation of their prescriptions and consumed medications. Moreover, the history of falling during the previous 12 months was obtained through the information form and interview with the subjects.
Results: In total, 883 males (54.6%) and 733 females (45.3%) were studied whose mean age was 69.37±7.42 (70±7.7 and 69.7±7.00 in males and females, respectively). In this study, 288 (17.8%) of the participants had the experience of falling in the last 12 months. The prevalence of falling was higher in elderly females (P<0.001) and the subjects who lived alone (P=0.01). Furthermore, it was found that the prevalence of falling in the elderly had a significant relationship with other diseases, namely osteoporosis (P<0.001), myocardial infarction (P=0.03), fractures (P<0.001), cognitive impairment (P=0.001), and headache (P=0.002). In addition, the results of logistic regression showed that the prevalence of falling had an association with urinary incontinence (P=0.02), history of fracture (P=0.001), hearing loss (P=0.006), and depression symptoms (P=0.001).
Conclusion: According to the results, there was a significant prevalence of falling among the subjects which had a direct relationship with some chronic diseases. Therefore, it is necessary to ask related questions from the elderly who refer to the health centers and be more careful about them.

Keywords: Chronic disease, Elderly, Falling

1. Background

Old age is a critical period of human life during which the form and function of internal and external organs change and make it difficult to adapt to the environment. Therefore, attention to the needs of the elderly is a social necessity (1). Currently, the world's aging population growth is 2.4%, and the number is expected to grow to 3.1 in the future, while the rate of the growth of the entire population is 1.7% (2). Due to the rapid growth of the elderly population, various dangers threaten them (3).

The fall is one of the major causes of death and morbidity among the elderly (4) and has incurred a significant financial and care burden on the health systems (5). In various studies, the prevalence of falling among the elderly was reported from 13.8-19.8% (6,7). The prevalence rate of falling among adults aged 65 and above in the United States has increased from 28.2% in 1998 to 36.3% in 2011 (8). According to the findings of another study, the prevalence rate of falling during the previous year in Canada was reported at 19.8% while 63.3% had fallen more than once and 36.7% more than twice (6). A

study in Iran also found that the prevalence rate of the falling of the elderly at home was 35.1% (9).

Several risk factors are associated with falling of the elderly people, such as frailty, sensory impairment, multimorbidity, vitamin D deficiency, polypharmacy, and home hazards (10). Yadollahi et al. reported old age and falls as the most important causes of spinal cord injuries (11). Increase of chronic diseases in the elderly leads to an increase in the number of consumed medicines by them (12). Based on the results of a study, chronic diseases, such as arthritis, diabetes, visual impairment, and especially hypertension and chronic obstructive pulmonary disease have led to the increase of falls among the elderly (6). In addition, about 90% of the elderly have at least one chronic disease while 65-85% of them have two or more chronic diseases (6,13). Furthermore, the elderly with chronic diseases are more exposed to the risk of falling, compared to those with no chronic diseases (6).

Therefore, falling is an important cause of injury, disability, and hospitalization among the elderly has a major impact on the quality of their lives and causes an increase in healthcare costs (14). Despite the fact that

many studies in Iran have just investigated the prevalence of falling and related factors in general, no study has been conducted on the relationship between the falling and chronic health conditions in the elderly.

2. Objectives

This study aimed to investigate the correlation between chronic health conditions and falls in the elderly population of Amirkola, Iran.

3. Methods

The present cross-sectional study was designed according to the Amirkola Health and Ageing Project (AHAP) cohort (15), which was the first cohort study performed on the Iranian elderly population in Amirkola city. In total, 1616 elderly people were enrolled in the study during 2011-12, In addition, the subjects whose information was incomplete or could not provide the correct information due to cognitive impairment were excluded from the study and the reminders entered to the research. This study has approved by the Ethics Committee of the Babol University of Medical Sciences (code of ethics: IR.MUBABOL.HRI.REC.1397.013).

The data were collected through a checklist, including age, gender, level of education, occupation, marital status, living status (living alone or not), level of income, history of falls, and frequency of falls. History of falls was examined in an interview with elderly people in which they were asked whether they had fallen during the past 12 months or not. If the answer was positive, they were asked again how many times they had experienced falling during the last 12 months? Through self-report, examination, laboratory tests, standard questionnaires, and observation of prescriptions and consumed medications of the patients, the presence of chronic diseases was determined.

Afterward, the subjects were asked whether they had been diagnosed with a specific disease or not. If an elderly person reported that he or she had a particular health problem, their medical records or patient history were examined, and in case of the lack of medical records, it was considered negative. In this study, chronic diseases included diabetes mellitus, osteoporosis, stroke, dementia, depression, Parkinson, epilepsy, hypertension, heart diseases (heart attack,

angina pectoris, and heart failure), chronic obstructive pulmonary disease (COPD) (chronic bronchitis, asthma, and emphysema), and various fractures that at least had existed three months throughout the year. For some diseases, such as hypertension, diabetes, depression, cognitive impairment, hypo, and hyperthyroidism, measurements were taken as well.

The presence of depression symptoms was investigated using the Geriatric Depression Scale which is a 15-item questionnaire that helps to divide the patients into several groups based on their cumulative scores. The patients were divided into normal (0-4), mildly depressed (5-8), moderately depressed (9-11), and severely depressed (12-15) (16). The Mini-Mental State Examination was used to evaluate the cognitive status of the elderly. It contains 11 items and evaluates five cognitive functions, namely orientation, attention, memory, language, and visual-spatial skills. The maximum score is 30 points and a score of equal or less than 24 indicates cognitive impairment (17).

The data were analyzed using t-test, chi-square, and logistic regression. The logistic regression was used to investigate the relationship between chronic diseases and the falling of the elderly people. Statistical analyses were performed in SPSS software (version 19). A p-value of ≤ 0.05 was considered statistically significant.

4. Results

The present study was performed on 1616 subjects, including 883 males (54.7%) and 733 females (45.3%) whose mean age was 69.37±7.42 (69.96±7.69 and 68.7±7.04 in males and females, respectively). Moreover, 1377 of the participants (85.3%) were married and 238 (14.7%) were single. In terms of the level of education, 64.6% of the subjects were illiterate. Besides, the majority of them (35.5%) were within the age range of 60-64 years old. Furthermore, 18.8% of them were smokers and 6.7% lived alone.

In this study, 288 (17.8%) of the studied elderly had fallen in the last 12 months. The prevalence of falling among elderly females was significantly higher than in elderly males (P<0.001). In addition, the rate of falling in elderly people who lived alone was significantly higher than those who lived with family members (P=0.01) (Table 1).

Table 1. Frequency distribution and percentage of the demographic characteristics associated with falling during the last 12 months in the elderly population of Amirkola

Demographic variables		Falls during the last 12 months N (%)	p-value
Gender	Female	164 (22.4)	0.001
	Male	124 (14)	
Living condition	Alone	29 (26.9)	0.01
	With family	259 (17.2)	
BMI	<25	95 (19.2)	0.7
	25-29.99	117 (18.1)	
	≥30	62 (17)	

As shown in Table 2, the prevalence rate of falling in the subjects during the last 12 months had a significant relationship with the diseases of osteoporosis (P<0.001), heart attack (P=0.03), history of fracture (P=0.000), urinary incontinence (P=0.000), hearing loss (P<0.001), depressive symptoms (P<0.001), and cognitive impairment (P<0.001). Moreover, regarding visual acuity, the rate of falling increased from 18% in people with normal vision to 30.8% in people with vision impairment (P=0.009).

Based on Table 3, the elderly who had fallen in the last 12 months had more illnesses (P<0.001). In addition, falling (P=0.002) was more common in subjects with depression symptoms (P<0.001), imbalance (P<0.001), consumption of several medications (P=0.001), and less weight (P=0.001).

The logistic regression model was used in order to determine the role of effective variables on falls. According to the crude model, variables, including age, body mass index, COPD, Parkinson, arthritis, diabetes mellitus, hypertension, polypharmacy, visual state, and hypothyroidism were not significant. Based on the adjusted model, the most influential variables on falling were history of fracture, old age, and urinary incontinence, loss of hearing, and depression symptoms, in that order (Table 4).

Table 2. Frequency distribution and percentage of chronic diseases associated with the falls during the last 12 months in the elderly population of Amirkola

Chronic diseases		Falls during the last 12 months N (%)	p-value
Osteoporosis	Yes	52 (27.5)	0.001
	No	236 (16.5)	
Stroke	Yes	19 (22.9)	0.2
	No	269 (17.6)	
Parkinson	Yes	4 (23.5)	0.5
	No	284 (17.8)	
Heart diseases	Yes	24 (26.4)	0.03
	No	264 (17.3)	
Chronic obstructive pulmonary disease	Yes	27 (22.3)	0.18
	No	261 (17.5)	
History of fracture	Yes	103 (24.7)	0.001
	No	185 (15.4)	
Urinary incontinence	Yes	110 (27.6)	0.001
	No	178 (14.6)	
Hearing loss	Yes	164 (21.8)	0.001
	No	124 (14.4)	
Arthritis	Yes	58 (18.4)	0.7
	No	230 (17.7)	
Depressive symptoms	Yes	176 (25.1)	0.001
	No	112 (12.3)	
Diabetes mellitus	Yes	97 (20)	0.16
	No	185 (17.1)	
Hypertension	Yes	183 (18.6)	0.4
	No	99 (17)	
Hypothyroidism	Yes	14 (20.9)	0.5
	No	274 (17.7)	
Cognitive impairment	Yes	114 (22.4)	0.001
	No	174 (15.8)	
Polypharmacy	Yes	75 (20.1)	0.2
	No	213 (17.2)	

Table 3. Mean and standard deviation of the risk factors (demographic characteristics and chronic disease) of falling in the elderly population of Amirkola during the past 12 months

Demographic variables and chronic diseases	Falls during the last 12 months		p-value
	Yes	No	
	Mean ± SD	Mean ± SD	
Age	70.66±7.93	69.09±7.3	0.002
Weight	65.02±11.51	67.76±14.3	0.001
Body mass index	26.94±4.24	27.27±4.65	0.2
Number of medications	3.07±2.77	2.5±2.63	0.002
Number of chronic diseases	3.45±2.11	2.56±1.88	0.001
Depression symptoms	5.99±3.59	4.27±3.37	0.001
Balance score	48.95±8.17	51.05±7.53	0.001

Table 4. Odds ratio and confidence interval for the association between falls over the past 12 months and the related factors in the crude and adjusted logistic regression model in the elderly population of Amirkola

Variable	Crude odds ratio (CI 95%)	p-value	Adjusted odds ratio (CI 95%)	p-value
Gender (female)	1.77 (1.37-2.29)	0.001	1.28 (0.94-1.75)	0.12
Living Alone (yes)	1.77 (1.13-2.76)	0.012	1.38 (0.86-2.22)	0.18
Osteoporosis (yes)	1.91 (1.35-2.71)	0.001	1.05 (0.69-1.59)	0.83
Heart diseases (yes)	1.71 (1.05-2.77)	0.03	1.35 (0.79-2.31)	0.26
Urinary Incontinence (yes)	2.22 (1.70-2.91)	0.001	1.49 (1.08-2.05)	0.02
History of fracture (yes)	1.80 (1.37-2.36)	0.001	1.65 (1.21-2.24)	0.001
Headache (yes)	1.50 (1.16-1.93)	0.002	0.96 (0.70-1.32)	0.78
Loss of hearing (yes)	1.66 (1.29-2.15)	0.001	1.46 (1.11-1.92)	0.006
Depression symptoms (yes)	2.40 (1.85-3.11)	0.001	1.68 (1.24-2.25)	0.001
Cognitive impairment (yes)	1.54 (1.18-2.01)	0.001	1.16 (0.86-1.57)	0.33
Number of medications	1.08 (1.03-1.13)	0.001	0.99 (0.94-1.06)	0.94
Number of chronic diseases	1.24 (1.17-1.33)	0.001	1.07 (0.96-1.20)	0.22
Balance score (BBT)	0.97 (0.96-0.98)	0.001	0.99 (0.98-1.01)	0.77

CI: Confidence Interval, BBT: Berg Balance Scale

5. Discussion

In total, 288 (17.8%) subjects had the experience of falling over the last 12 months. The prevalence rates of falling were 25.8% and 22.7% in the studies performed by Brito et al, in Brazil [18] and Ghasemi et al. [19], respectively. In these studies, the prevalence rates of falling were close to the one found in the present study.

In this study, the prevalence rate of falling was higher in females (22.4%), compared to males (14%). Based on the results of a study performed by Na'emani et al., this rate was 16% and 12% in females and males, respectively [20]. In other studies, falling was also more prevalent among older females, compared to males [21,22]. The results of these studies were consistent with those of this study. However, in the present research, there was an insignificant relationship between age and the prevalence of falling. The higher prevalence of falling in older females may be due to the higher prevalence of osteoporosis in them and their fear of falling. Moreover, an increase of age leads to an increase in the elderly's disability and dependence which exposes them to the risk of falling.

Based on the results of this study and the logistic regression model, the most effective variable on the prevalence of falls in the elderly was a history of fracture, depression symptoms, loss of hearing, and urinary incontinence. However, based on the raw model of statistic analysis, the incidence of the falls in the elderly in the past 12 months had also a relation with the number of their chronic diseases, female gender, life on their own, osteoporosis, heart failure, headache, loss of hearing, number of consumed medications, score of balance, depression symptoms, and cognitive impairment.

In a similar study conducted in the United Kingdom, the risk factors of falling were based on multivariate statistical analysis, including old age (in both genders), urinary incontinence, depression symptoms, non-marital status (in females), more diseases, imbalance, and more pain (in men) [23].

In another study, the risk factors of falling in the elderly included balance and walking disorder, polypharmacy, history of previous falling, cognitive impairment, and environmental factors [4]. With regard to some of the variables, the results of these studies are similar to our study. However, there are differences in other variables that may be due to the different lifestyles of elderly people in Iran and other countries, as well as the economic and social differences of the life of the elderly in different communities.

Based on the findings of a study carried out by Dhalwani et al., the risk of falling in patients with polypharmacy was 21% higher than those without polypharmacy. Moreover, they found that the simultaneous consumption of four or more medications increases the risk of falling by 18% while using 10 or more medications increases this risk by 50% [24]. In another study conducted in Iran, there was a relationship between the falling of the elderly and using hypnotic medications [9]. In the present study, no significant relationship was observed between the falling of elderly people and polypharmacy; however, falling was more prevalent in elderly people with polypharmacy.

Based on the results, elderly people with falling experience during the last 12 months had been prone to more diseases. In addition, it was found that falling was more prevalent among elderly females with depression symptoms and balance disorders. In a study performed by Sibley et al., hypertension and COPD were clearly associated with the increased risk of falling [6]. However, in this study, falling had no significant relationship with hypertension and COPD. Nevertheless, it was observed that falling was more common in elderly people with these diseases.

According to the results of a study performed by Abreu, urinary incontinence was a strong predictor of falling in elderly people [25] which is in line with the findings of the present study that indicated a significant relationship between falling and urinary incontinence in the elderly. In addition, Gale et al. in their study found that urinary incontinence and

weakness are predisposing factors of falling in females while severe depression symptoms and balance disorders are risk factors of falling in males (26).

In another study, osteoporosis was regarded as a risk factor for falling (25) which is also consistent with the findings of the present study. Patients with osteoporosis often suffer from muscle weakness and kyphosis which result in poor balance and falling. Therefore, improvement of muscle strength and body condition are essential elements for the prevention of falls and fractures in the elderly (27).

In the present study, it was found that falling was associated with hearing loss in elderly people. Similarly, in another study, it was reported that hearing loss could increase the risk of falling in the elderly. This disorder reduces the quality of life and causes difficulty in walking, cognitive impairment, functional weakness, and isolation (28). Another study found that the increase of hearing loss led to an increase in the falling of elderly people during the last 12 months (29). Loss of hearing reduces the performance of individuals, increases their disability and dependence, and exposes them to the risk of falling which indicate that the elderly need more attention.

In the present study, falling was more prevalent in elderly people who lived alone (26.9%), compared to those who lived with their families (17.2%). Similarly, Lee et al. in their study found that falling was more common in elderly people who lived alone in comparison to the other groups (30). In addition, based on the findings of a study performed by Mortazavi et al., the prevalence of falling in the people who lived alone (51.1%) in both genders was clearly higher, compared to others (28.4%) (22).

The results of another study indicated a correlation between falling in elderly people and the presence of depression symptoms (31), which is similar to the results of this study. Therefore, in order to prevent the problems caused by living alone in elderly people, some proper measures should be taken to increase their social interactions.

5.1. Strength and Limitations

One of the limitations of this research was its cross-sectional design which made it difficult to investigate the causal relationships between chronic diseases and falling. Moreover, the self-reporting nature of the data collection tools deprived us of more precise data about the prevalence of chronic diseases in the elderly. This is a significant limitation since many chronic diseases are asymptomatic or have mild symptoms in the early stages and the patient may not be aware of it. Moreover, in patients with lower socioeconomic status, chronic diseases are diagnosed late or are rarely reported due to fewer investigations. One of the strengths of the present study was its population-based cohort design and the high participation rate of the elderly male population in Amirkola.

6. Conclusion

The results indicated a significant prevalence of falling in elderly people and its direct relationship with some chronic diseases. The falling in elderly people has an important impact on their life quality since it is an important cause of their injuries, disabilities, hospitalization, and death, and also increases healthcare costs.

Furthermore, due to their inability to express some chronic diseases, such as urinary incontinence, depression, and loss of hearing, more attention should be paid to these diseases by doctors and healthcare workers in health centers. Therefore, the results of this study indicated the necessity of proper plans for the prevention of falls, such as interventions, educational plans, support of the families of the elderly, accurate and continuous screening, and timely diagnosis and treatment of their chronic diseases.

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Footnotes

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