

THE CONSEQUENCES OF FALLS TO PHYSICAL ACTIVITY, SLEEP DURATION AND QUALITY OF LIFE AMONG OLDER INSTITUTIONALIZED ADULTS

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Abstract

Objective: Falls are among “the ‘giants’ of geriatrics”. The aim of the study was to examine the consequences of falls to physical activity (PA), sleep duration and quality of life (QoL) among institutionalized older people.

Methods: 253 residents of three nursing homes at the age of 65 years or more participated in the study. Falls were registered during one year and after this time the Stanford Usual Activity Questionnaire was performed with each subject and each subject answered the questions concerning the sleep duration. The QoL was examined with the EuroQol-5D questionnaire.

Results: Falls occurred in 103 subjects. The subjects with the history of fall were characterized by a lower level of PA, lower number of sleep hours and lower basic activities of daily living. In the EuroQol 5D questionnaire responses indicating mobility, self-care and anxiety problems were more pronounced in fallers.

Conclusions: Low level of PA is a serious consequence of falls occurrence. History of falls is related to shorter sleep duration. PA and sleep restrictions as well as worse functional capacity may consequently deteriorate the quality of life among older institutionalized adults. Future studies should assess prospectively the bidirectional relationship of lower PA and falls as well as the influence of other factors such as sarcopenia or frailty.

Key words: elderly, falls, physical function, quality of life, sleep duration

Introduction

The risk of many medical problems increases with age. Among people over the age of 65 one can find problems that are due to their prevalence in this age group, complex causes, progressive course, therapeutic difficulties and consequences such as the loss of independence, increasing morbidity and mortality rates. These problems called “the ‘giants’ of geriatrics” include, inter alia, immobilization, urinary incontinence, cognitive, visual and hearing impairment and depression. This group also includes falls, defined as a sudden, unintentional change in position causing an individual to land at a lower level, on the floor, or the ground as a result of loss of balance while walking or performing other actions [1,2]. Falls constitute the predominant cause of accidental death in older people [3] and falls-related mortality increases dramatically with advancing age, especially in people older than 70 years [4]. One out of three community-dwelling older adults have a history of at least one fall each year. The incidence of falls is higher in institutionalized older people - at least half of nursing home residents aged ≥ 65 fall each year.

Apart from short-term negative impact the history of fall could have an impact on the long-term consequences related to behavior and daily activities. A common result of a fall (although it also applies to a large group of people who have never fallen) is a condition

associated with the fear of falling called the post-fall anxiety syndrome [5,6]. It increases the risk of falling and as a consequence leads to a significant reduction in physical activity (PA) and a further collapse of overall health as a result of inactivity. The post-fall anxiety syndrome leads to functional decline, social isolation and poor QoL [6,7].

Falls have been connected with sleep disruptions and short sleep duration [8-10]. On the other hand sleep duration may be longer in comparison with people without a history of fall [11,12]. People with a history of at least one fall rate their QoL lower in comparison with non-fallers [13,14]. The complex relationship between falls and PA, sleep duration and finally QoL has not been systematically reported in the literature. Therefore, the aim of the present study was to examine the relationship between a history of falls and daily amount of PA, sleep duration, and also to assess the influence of falls on QoL in nursing homes residents.

Methods

Participants

The residents of three nursing homes over 65 years old, who expressed their voluntary consent to participate in research, have taken part in the study. The study was conducted among 253 nursing home residents who met the inclusion criteria, 212 women

and 41 men aged from 65 to 99 years (average 79.1 ± 7.3 years). The criteria for taking part in the study were age, verbal-logical contact and patient's approval of the study. Among all nursing home residents less than 40% was able to participate in the study. These people, having understood the information for the patient regarding performance in the tests approved to participate. The participants had been diagnosed with the following concomitant diseases: **hypertension** (198 persons), chronic heart failure (187 people), ischemic heart disease (152 patients), myocardial infarction in anamnesis (35 patients), stroke in anamnesis (62 patients), diabetes mellitus (56 persons), osteoarthritis (144 people), eye diseases (94 patients), osteoporosis (96 people), urinary incontinence (145 people), fecal incontinence (87 people), hypercholesterolemia (77 people), depression (62 patients), chronic obstructive pulmonary disease (62 patients), gastrointestinal diseases (55 people) and cancers (26 patients). The study was approved by the Bioethics Committee of the Medical University of Łódź and written informed consent was obtained from all the subjects.

Methods

A multi-dimensional assessment was performed with each subject. The assessment included demographic variables, health status and physical function. Falls were registered for one year before the clinical and functional examination. Anthropometric data: body height and mass were measured, waist and hip circumferences were taken, BMI and WHR were calculated. The functional status assessment of respondents was carried out by questionnaires and scales included in the Comprehensive Geriatric Assessment: Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL) and the Timed Up-and-Go test (TUG). In our previous study we have reported on the relationship between falls and infections, nutri-

tion, cognitive functioning and functional status [18]. PA assessment was performed by the Stanford Usual Activity Questionnaire [15], which is characterized by its high validity in older subjects [16]. The Stanford Usual Activity Questionnaire [15] consists of 6 questions which evaluate six habitual moderate activities. Only 3 of all subjects reported any Stanford Vigorous activity. Therefore, it was not demonstrated in this paper. The participants were asked about the number of sleep hours during the last week. QoL assessment was performed with EuroQol-5D questionnaire [17]. EuroQol-5D is used in clinical trials to assess the following 5 dimensions: mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Each of them is evaluated on 1 of 3 levels: no problems, some problems, severe problems [17,19,20].

Statistical analysis

Data was verified for normality of distribution and equality of variances. The one-way analysis of variance (ANOVA), Mann - Whitney test and chi-square test were used to compare the groups. Statistical analysis was performed using the statistical program Statistica 10th CSS. The results of the quantitative variables are presented as mean $\pm$ SD (standard deviation). The limit of significance was set at $P \leq 0.05$ for all analyses.

Results

One hundred and three older subjects out of the 253 surveyed had a history of at least one fall during one year (Table 1). There was a tendency which indicated a relationship between increased risk of falling and the age of the respondents. The falls occurred with a similar frequency in men and women. The residents with the history of falls were characterized by a statistically significantly lower PA level accordingly to the Stanford Usual Activity Questionnaire and shorter sleep duration. There was

Table. 1. *Physical activity, sleep duration and functional status in a group with the history of fall and without fall history*

	Fallers n = 103 ($\bar{x} \pm SD$)	Non-fallers n = 150 ($\bar{x} \pm SD$)	Statistical significance <i>P</i>
Age	80.2 $\pm$ 7.14	78.4 $\pm$ 7.42	0.052
Women (%)	86.4%	82.0%	0.35
Stanford Moderate Score	0.77 $\pm$ 1.08	0.95 $\pm$ 1.01	0.048
Sleep duration (hours/week)	54.7 $\pm$ 13.4	58.1 $\pm$ 11.9	0.03
BMI	25.5 $\pm$ 5.6	26.2 $\pm$ 7.5	0.39
WHR	0.84 $\pm$ 0.13	0.85 $\pm$ 0.12	0.24
ADL	3.47 $\pm$ 1.99	3.78 $\pm$ 2.18	0.040
IADL	1.74 $\pm$ 1.91	2.13 $\pm$ 2.14	0.18
TUG	12.0 $\pm$ 13.8	9.5 $\pm$ 11.9	0.12

BMI: body mass index; WHR: waist-to-hip ratio; ADL: Activities of Daily Living; IADL: Instrumental Activities of Daily Living; TUG: timed up-and-go test.

Table 2. *EuroQol 5D questionnaire in a group with the history of fall and without fall history*

EuroQol 5D	Fall n = 103(%)			Lack of fall n = 150(%)			Statistical significance <i>P</i>
	a	b	c	a	b	c	
Mobility	15 (14.56%)	43 (41.75%)	45 (43.69%)	40 (26.67%)	66 (44.00%)	44 (29.33%)	0.02
Self-care	27 (26.21%)	36 (34.95%)	40 (38.83%)	45 (30.00%)	70 (46.67%)	35 (23.33%)	0.03
Usual activities	11 (10.68%)	39 (37.86%)	53 (51.46%)	25 (16.67%)	60 (40.00%)	65 (43.33%)	0.29
Pain/discomfort	12 (11.63%)	78 (75.73%)	13 (12.62%)	24 (16.00%)	110 (73.33%)	16 (10.67%)	0.59
Anxiety/depression	16 (15.53%)	68 (66.02%)	19 (18.45%)	32 (21.33%)	104 (69.33%)	14 (9.33%)	0.04

a general tendency towards worse functional status in fallers with a statistical significance level between risk of falling and ADL scale (Table 1).

In the EuroQol 5D questionnaire, for questions about mobility, self-care and anxiety, responses “b” and “c” indicating problems with performance were more frequent in the subjects with the history of fall. The occurrence of these problems was significantly greater in fallers as compared to non-falling group (Table 2).

Discussion

Changes with age increase the risk of disability. However, much of what is considered to be the ageing process may be really caused not by ageing per se but by inactivity. Older people can regain 27% of muscle strength reversing age related decline by 15 years by attending one exercise classes a week and doing home exercises [3]. According to some studies PA is not significant predictor of falls [10], whereas other studies show that the presence of physical limitations is significantly associated with falls, for example in incontinent subjects [21]. Our research shows that the subjects with the history of fall are significantly less active than those without fall history. It may be connected with the fact that less active seniors because of their lower level of PA were characterized by less strength and balance what consequently led to falls occurrence. Low level of fallers' PA goes along with their worse physical functioning and it may be also connected with the fear of falling or the post-fall anxiety syndrome. The fear of falling as the negative consequence of falls is an independent predisposing factor for reduced physical status including mobility, balance, and PA involvement. This post-fall anxiety syndrome often caused restrictions both in daily functional activity and recreational activity [22,23]. Fallers excessively limit their activity what contributes to deconditioning, weakness and abnormal gait and in the long run may increase the risk of recurrent falls [4]. It is also possible that there was some third factor

(such as sarcopenia or frailty) which led to both falling and reduced PA.

In our study non-fallers were characterized by greater number of sleep hours in comparison with subjects with the history of fall. Similar results were obtained by Kuo et al. [8] who claimed that short sleep duration (less than 5 hours) may be an indicator to identify women at risk for falling. According to Swartzell et al. [9], every patient who stays in acute care hospital to a certain extend has greater risk of falls due to the different risk factors existence which include the sleep disturbances. In contrast, Mesas et al. [12] found that long sleep duration increased the frequency of falls in older subjects independently of health status, comorbidity or sleep quality. It was found that recurrent falls occurred more often in subjects who usually slept 11 hours or longer in comparison with people who slept 7-8 hours daily. Helbig et al. [11] found that 9 hours of daily sleep duration was significantly associated with the incidence of at least one previous fall. According to some studies, the prevalence of sleep problems also significantly increased the risk of falls [10,24]. Among subjects aged 85 or older insufficient sleep was one of factors independently associated with a greater risk of falls or fall related injuries [25]. Women who experienced an abnormal level of daytime sleepiness had the risk of falling twice greater in comparison with women without this problem [26]. Additionally, medications used to treat sleep problems might contribute to the risk of falls and fractures in this population [27]. It may explain the recurrent falls prevalence - patients who experienced fall, more often suffer from the sleep problems and limit their PA what makes them more vulnerable to experience recurrent falls. In the present study we found also the general tendency towards lower physical functioning in group of fallers. Thus, people with the history of falls were characterized by shorter sleep duration, lower PA level, and consequently also by worse basic functional status.

Insomnia is common among older people and it may have negative influence on significant daytime dysfunction increasing the risk of falls [27].

Critical aspects of functioning for seniors who aspire to maintain independent living and a satisfactory quality of life include both mobility and basic activities of daily living [28]. In our study people with the history of fall were characterized by worse QoL compared to people without falling. Among these patients, there were significant differences in terms of mobility, self-care and anxiety, which showed that fallers' results in these three dimensions connected with their self-esteem were worse. It seems to be connected with the fact that because of declining PA and functional status, and also shortening of the sleep duration among fallers, their QoL worsened as well. Our findings are in line with several other studies. Ribeiro et al. [13] found that the QoL was changed by falls in negative way and it was deteriorated among people who suffered falls during the last year in comparison with people who did not fall during this time. Thiem et al. [29] found that both single and frequent falls keep an independent negative association to quality of life, even independently of other diseases and conditions. Subjects who experienced both urinary incontinence and falls were significantly more likely to report effects on their social life, symptoms of upset or distress and a perception of a poor QoL [21]. The most negative effect on QoL had living in long-term care [30] and it seems to be important that falls are often the reason for locating seniors in nursing homes.

Concluding, falls contribute to the post-fall anxiety syndrome occurrence leading to lower level of PA, worse functional status and shorter sleep duration. Those consequences of falls occurrence seem to consequently deteriorate the QoL of older institutionalized subjects. Falls significantly worsen the QoL in terms of mobility, self-care and anxiety. Future studies should assess prospectively the bidirectional relationship of lower PA and falls as well as the influence of other factors such as sarcopenia or frailty.

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Declaration of interest

The authors report no conflicts of interest.

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Authors' contribution

A – Study Design

B – Data Collection

C – Statistical Analysis

D – Data Interpretation

E – Manuscript Preparation

F – Literature Search

G – Funds Collection