

Association between Fear of Falling, Balance and Functional Mobility in the Elderly

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Abstract

Background: Falling is the main problem that causes fear of falling in the elderly. Impaired balance is an important factor that causes falling. Falls Efficacy Scale-International (FES-I) is a tool to measure fear of falling, while balance condition can be measured using Biodex Balance System-SD (BBS-SD). Moreover, Timed up and Go Test (TUG) is a tool to measure functional mobility. The research aimed to determine correlation between fear of falling, balance and functional mobility in the elderly.

Methods: The research was conducted in 39 elderly subjects at Outpatient Medical Rehabilitation Clinic of Dr. Soetomo General Hospital, Surabaya, Indonesia, who were measured using FES-I, BBS-SD and TUG.

Results: The FES-I and BBS-SD probability values showed no correlation between fear of falling and balance, with $p=0.064$ ($p>0.05$). Moreover, the FES-I and TUG probability values also showed no correlation between fear of falling and functional mobility, with $p=0.251$ ($p>0.05$).

Conclusion: There was no correlation between fear of falling, balance and functional mobility in the elderly at Outpatient Medical Rehabilitation Clinic of Dr. Soetomo General Hospital, Surabaya, Indonesia.

Keywords: *balance, elderly, fear of falling, functional mobility*

Introduction

The aging process is not a disease or a disability condition, even though most elderly suffer from functional decline that is often caused by various chronic diseases that generally accompany the aging process. The aging process is the sum of all changes that occur by the time. These changes become the cause or are strongly related with increased body vulnerability to stimuli from within and outside the body. The real example of this aging process is a gradually limited body function capacity and reduced speed capacity¹. There are some peculiarities of elderly patients. Those peculiarities

include more diseases, unspecified disease symptoms, reduced physiological reserves, drug sensitivity and complex biopsychosocial problems².

Falling is the most common incidence experienced by elderly, and it may result in morbidity and mortality. Falling occurs when a person suddenly loses balance that eventually makes a contact with floor or other surfaces. There are many factors can cause falling in the elderly, one of which is fear of falling³. Fear of falling commonly occurs in the elderly, and it correlates with decreased balance, anxiety, depression and falling history. A community-based epidemiology study reported 32-83% incidence rates in the elderly, and 33-46% of the elderly who did not fall were afraid of falling. In the elderly who experienced fear of falling, almost 70% of them avoided activities because of fear of falling. In some cases, elderly people confine themselves at home because of the fear. The activity limitation is actually a risk factor of falling because it can lead to muscle atrophy, decreased condition and balance. In

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addition, this limitation cause social isolation, decreased functional activity and life quality ⁴. This research was conducted to analyze correlation between fear of falling, balance and functional mobility in the elderly. Fear of falling can be measured using Falls Efficacy Scale-International (FES-I) questionnaire. Balance and functional mobility can be measured using Biodex Balance System-SD (BBS-SD) and Timed up and Go Test (TUG) respectively.

Method

This research is an observational analytic study using cross sectional study design. The study was conducted in Medical Rehabilitation Unit of Dr. Soetomo General Hospital and Universitas Airlangga Hospital, Surabaya, Indonesia, from January-March 2014. The samples met inclusion criteria (males and females aged 60-89, can walk at least 6 meters without aids and can obey simple commands) and had willingness to participate in the research by signing informed consent. The study protocol was approved by the ethics committees of Dr. Soetomo Teaching Hospital (Surabaya, Indonesia) ⁵.

There were 39 elderly subjects met inclusion criteria and not included in exclusion criteria. Functional mobility was measured using Timed Up and Go test, followed by a balance test using Biodex Balance System-SD. The data analysis was conducted using SPSS 17.0 software (SPSS, Inc., Chicago, IL). Afterward, the data were analyzed using Spearman’s correlation test since the data were ordinal ⁶.

Result

Demographic and clinical characteristics were presented in Table 1, with 39 subjects. The average subjects’ age was 67.03±6.32, with the youngest and oldest age were 60 and 80 respectively. There were 18 subjects aged 60-64 (46.15%), 7 subjects aged 65-69 (17.95%), 8 subjects aged 70-74 (20.51%), 4 subjects aged 75-79 (10.26%) and 2 subjects aged 80-84 (5.13%). Moreover, there were 8 male subjects (20.5%) and 31 female subjects (79.5%).

The results of fear of falling assessment using FES-I were less varied. The average FES-I value was 17.62±3.25, with the lowest value of 16 and the highest value of 35. The value ranged from 16 to 64, in which 16 indicated mild fear of falling and 64 showed severe fear of falling when performing 16 activities. The higher the

FES-I value, the greater the fear of falling. The FES-I assessment results were shown in Figure 5.1. The study found 34 subjects with FES-I value of 16-19 (87.2%), 4 subjects with FES-I value of 20-27 (10.3%) and 1 subject with FES-I value of 28-64 (2.6%).

The results of balance assessment using Biodex Balance System-SD were varied. The average stability index was 2.36±1.36, with the lowest value of 0.60 and the highest value of 4.90. The higher the stability index, the balance gets worse thus the risk of falling is greater.

The results of functional mobility using TUG test were greatly varied. The average TUG time test was 11.33±2.73, with the lowest value of 7.90 seconds and the highest value of 20.80 seconds. The larger the TUG time, the functional mobility capacity gets worse. The assessment data were presented in Table 2.

The results of statistical test using Spearman’s correlation test showed no correlation between fear of falling, balance and functional mobility, with r=0.300 and p=0.064 (Table 3). Fear of falling did not correlate significantly with TUG, with r=0.188 and p=0.251 (significant correlation if p<0.05; Table 3)

Table 1 Subjects’ characteristics

Variables	Frequency	%
Age (year)		
60-64	18	46.2
65-69	7	17.9
70-74	8	20.5
75-79	4	10.3
80-84	2	5.1
Sex		
Male	8	20.5
Female	31	79.5

Table 2 FES-I, IS and TUG assessments

Variables	N	Mini-mum	Maximum	Mean	SD
FES-I	39	16	35	17.62	17.62±3.25
IS	39	0.60	4.90	2.36	2.36±1.36
TUG	39	7.90	20.80	11.33	11.33±2.73

Table 3 Correlation between FES-I and Age, IS and TUG

		FES-I
Age	r p N	0.337 0.036 39
IS	r p N	0.300 0.064 39
TUG	r p N	0.188 0.251 39

Annotation:

r: correlation coefficient

p: p shows probability or significance level. Significant if $p < 0.05$.

Discussion

The subjects' average age showed fewer subjects in the age group of elder patients. This finding correlated with average life expectancy in Indonesia (70.7 years), thus the number of elderly in Indonesia decreased with age. The subject distribution showed varied numbers of elderly subjects by age. The ratio of male to female subjects was quite far (1:3), with 8 male subjects (20.5%) and 31 female subjects (79.5%).

Fear of falling was measured using FES-I as it has good psychometric elements and it was utilized to measure fear of falling in some studies.. FES-I has been tested for validity after being translated into Greek. The average results of fear of falling assessment using FES-I was 17.62 ± 3.25 , with the lowest value of 16 and the highest value of 35. The value ranged from 16 to 64, in which 16 indicated mild fear of falling and 64 showed severe fear of falling when performing 16 activities. The higher the FES-I value, the greater the fear of falling. 34 subjects (87.2%) had mild fear of falling, thus they felt very unlikely to fall when performing 16 activities. There were 4 subjects (10.3%) with moderate fear of falling and 1 subject (2.6%) with severe fear of falling.

The research found a significant correlation between fear of falling and age ($p=0.036$). This finding was consistent with the previous study which reported that

fear of falling commonly occurred in females compared to males, and it usually increased with age.

The results of balance assessment using Biodex Balance System-SD were varied. The average stability index was 2.36 ± 1.36 , with the lowest value of 0.60 and the highest value of 4.90. The higher the stability index, the balance gets worse thus the risk of falling is greater. There were 10 subjects (25.64%) having a stability index above normal, thus they had less balance which resulted in a greater risk of falling. Risk of falling in the study was found in 1 out of every 4 subjects, with ratio 1:3. If the subjects represented elderly in general, then the risk of falling in the elderly was quite large.

Functional mobility is a term used to describe balance condition and walking activity in daily life (such as sit, stand, walk, turn around). TUG test is a commonly used balance test to examine functional mobility in the elderly. The results of functional mobility assessment using TUG test were greatly varied. The average TUG time was 11.33 ± 2.73 , with the lowest value of 7.90 seconds and the highest value of 20.80 seconds. The larger the TUG time, the functional mobility capacity gets worse. There were 9 subjects (23.08%) having TUG time above normal, thus they had less functional mobility capacity (Figure 5.3). This was resulted from walking pattern changes which was adjusted with balance, including short and slow steps. Various cross sectional studies reported that increasing age affects walking pattern changes, including slow swing and wide base patterns, longer double leg support phase, decreased stride length and torso rotation⁷.

Frank and Patla measured correlation between capability, walking speed and fear of falling in 40 elderly subjects. They found that elderly with fear of falling showed limited capability and confidence in balance. Kalsait *et al* reported a correlation between fear of falling and physical performance, one of which is balance⁸. The present study found no significant correlation between fear of falling and balance ($p=0.064$). This finding might be resulted from a relatively small subject distribution with fear of falling (10.3% with moderate fear of falling and 2.6% with severe fear of falling)⁹.

The results showed no correlation between fear of falling and balance, as fear of falling is a psychological factor that is associated with falling in the elderly, whereas balance is a complex interaction between sensory/

afferent system (vestibular, visual and proprioceptive) and motor/efferent system (muscles, joints and soft tissues) processed in the brain in response to changes in internal (host) and external (environment) conditions¹⁰. As a result, response to fear of falling is not necessarily manifested as falling since intrinsic and extrinsic factors will respond to the body to maintain balance in order to avoid falling¹¹. Thus, self-efficacy based on psychology for fear of falling is merely one factor affecting balance. In clinical practice, this condition could be used as a precaution when serving elderly. It does not mean that elderly who has no fear of falling has a good balance, thus the risk of falling may remain¹².

The research found no significant correlation between fear of falling and functional mobility, with $p=0.251$. Falling risk identification could be performed by examining elderly balance condition when moving from one place/position to another. The study used TUG test to examine functional mobility. Someone needs a good balance to move from place/position to another. As we mentioned earlier, fear of falling is a factor affecting balance, thus there are other factors affecting elderly mobility. It can be concluded that elderly with good self-efficacy does not necessarily have good mobility since mobility is influenced by physical changes that occur with age¹². Meanwhile, conversely, elderly with fear of falling does not necessarily have bad functional mobility as fear of falling could be overcome with good physical condition. In clinical practice, this could become a consideration when serving elderly with fear of falling¹³. From these findings, we could provide educational/psychological support to the elderly that falling could be prevented if one has good balance. This objective can be achieved through a routine medical check and physical exercises to maintain balance. Rubenstein *et al* stated that exercise programs were recommended to improve confidence and fitness level to avoid falling and fear of falling. It was expected that physical and psychological problems affecting balance that may result in functional mobility could be addressed by performing an exercise activity¹⁴.

Conclusion

This research shows that fear of falling measured with FES-I questionnaire did not correlate with balance measured with Biodex Balance System-SD test. Moreover, fear of falling measured with FES-I questionnaire did not correlate with functional mobility

measured with Time Up and Go test.

Authors' contribution : Fatmawaty Abasmay do the laboratory research, Nuniek Nugraheni writes the report of the laboratory into this paper, while Reni Hendrarati Masduchi writes the result of the laboratory research.

Ethical Clearance: This research involves participants in the survey using sampling method that was accordant with the ethical research principle based on the regulation of research ethic committee. The present study was carried out in accordance with the research principles. This study implemented the basic principle ethics of respect, beneficence, nonmaleficence, and justice.

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