

Relationship of activity self-efficacy, mobility and balance in community dwelling elderly women

Tomonori Nomura, Toshiko Futaki*

Key words : fear of falling, self-efficacy, mobility, balance, elderly women

Summary

Fear of falling in the elderly has been reported to be more problematic than falling itself. Since conducting numerous living activities on the floor is a Japanese custom, we investigated the influence of vertical downward movement while standing, to clarify factors affecting activities restricted by fear of falling. The subjects were 44 elderly women (aged 74.8 ± 7.1 years) with independent outdoor mobility. As a measure of fear of falling, self-efficacy in the execution of activities was evaluated. A significant correlation was noted between activity self-efficacy and fear of falling ($r=0.417$, $p<0.01$). Factors correlated with activity self-efficacy were a) timed up and go test ($r=-0.324$, $p<0.05$), b) times required for sitting on the floor ($r=-0.321$, $p<0.05$), and c) going up and down a 15-cm step ($r=-0.365$, $p<0.05$). It is suggested that vertical movement while standing should be included in the evaluation of and intervention in fear of falling, in addition to mobility.

Introduction

Fall-associated fracture and trauma are factors reducing independence in conducting activities of daily living. Following recent progress in studies on falling prevention, fear of falling¹⁾ has been

reported to be more problematic than falling itself³⁾¹⁴⁾, and such a fear develops in elderly people who have not experienced falling²⁾. The incidence of fear of falling in elderly has been reported to be 25-55% in Europe and America⁴⁾⁻⁸⁾ and 50-60% in Japan⁹⁾¹⁰⁾, and activities were restricted due to fear of falling in 19-35% of these⁷⁾¹³⁾. Fear of falling restricts activities of daily living and their range in elderly people, despite their adequate mobility, and reduces physical function and quality of life (QOL)¹¹⁾¹²⁾.

Fear of falling is measured by directly questioning subjects on its presence or absence, or as activity self-efficacy. For measurement using self-efficacy, Tinetti et al.¹⁹⁾ developed the falls efficacy scale (FES) to measure the degree of fear of falling based on the self-efficacy theory proposed by Bandura¹⁵⁾. Several indices have been subsequently developed¹¹⁾²⁰⁾²¹⁾, and the usefulness of the combination of several indices to identify individual problems has been reported²²⁾.

In studies on fear of falling and physical function performed in Europe and America, fear of falling was significantly higher in a group with reduced equilibrium function and mobility¹⁶⁾⁻¹⁸⁾, showing the association of the fear with evaluation items of motor function involving

Department of Occupational Therapy, School of Health Sciences, Niigata University of Health and Welfare

*Human Health Sciences, Graduate School of Medical and Faculty of Medicine, Kyoto University

Address for Correspondence:

Tomonori Nomura

Department of Occupational Therapy, School of Health Sciences, Niigata University of Health and Welfare, 1398, Shimami, Niigata 950-3198, Japan

E-mail:nomura@nuhw.ac.jp

standing and moving. However, more elderly people with independent outdoor mobility report difficulty in standing up from, and sitting on tatami mats rather than a reduction of physical strength, such as in balancing and walking. Since conducting numerous living activities on the floor is a Japanese custom, which is different from Western life-styles, observation of not only physical function related to falling but also activities and motions specific to elderly Japanese is necessary. Thus, we hypothesized that the ability to stand up from, and sit on the floor affects activity restriction associated with fear of falling.

The objective of this study was to clarify factors affecting activities restricted by fear of falling via measuring the speed of reactions of physical functional factors reported to be associated with fear of falling and activities and motion suggested.

The hypothesis investigated was: ‘vertical downward movement from the standing position affects activities and motion restricted by fear of falling’.

Methods

1. Subjects

The subjects were 44 elderly women, aged 74.8 ±7.1 years (mean±SD; range: 65-88 years). All subjects showed independent outdoor mobility, and had no apparent motor disturbance nor dementia symptoms (Tables 1 and 2). This study was approved by the ethics committee of Kanazawa University .

2.Methods

Fear of falling, restriction of leaving the home due to fear of falling, experience of falling over the past one year, history of falling over the past one year and activity self-efficacy were surveyed. Regarding fear of falling, the subjects were asked, ‘are you fearful of falling?’, and chose the answer from ‘1: very fearful’, ‘2: slightly’, and ‘3: no’.

Table 1 Demographics of subjects

Female	44
Age (years)	
Mean	74.8
SD	7.1
Range	65-88
Living situation	
Alone	4 (9%)
An old couple	12 (27%)
With others	28 (64%)
Assistive device	
None	28 (64%)
Cane/Walker	16 (36%)
MSQ*	
Median (Range)	10 (8-10)

*MSQ: Mental status questionnaire

Table 2 Characteristics of participants’ main diagnoses

Knee joint pain	31 (70%)
Lower back pain	24 (54%)
Hypertension	23 (52%)
Osteoporosis	17 (38%)
Cataract	14 (31%)
Hip joint pain	9 (20%)
Dizziness	8 (18%)
Stroke	5 (11%)
RA	1 (2%)
Others	4 (8%)

Regarding restriction of leaving the home due to fear of falling, experience of having almost stumbled, and history of falling over the past one year, the subjects gave answers simply as present or absent. As questions on activity self-efficacy, the questions of Modified Falls Efficacy Scale (MFES)²⁰⁾, Activities-specific Balance Confidence (ABC)²¹⁾ and Survey of activities and fear of falling in the elderly (SAFE)¹¹⁾ used for the measurement of fear of falling were referred to, and items regarding activities and motions specific to elderly Japanese, such as ‘wiping the floor or tatami mat clean’, were added (Table 3).

Table 3 Activity self-efficacy items

Items
1 Get dressed and undressed
2 Get in/out of bed or bedding on a tatami mat
3 Sit down/stand up from a tatami mat
4 Use toilet independently
5 Take a shower
6 Take a bath
7 Walk around inside the house
8 Go up and down stairs
9 Simple cleaning
10 Wiping the floor or tatami mat clean
11 Prepare a simple meal
12 Simple shopping
13 Light housekeeping
14 Answer door or telephone
15 Reach into cabinets or closets
16 Reach at eye level
17 Pick up slippers from floor
18 Reach on tiptoes
19 Stand on chair to reach
20 Walk around house
21 Walk outside to nearby car
22 Get in/out of car
23 Walk across the road
24 Go up and down ramps
25 Walk across a parking lot
26 Take public transportation
27 Walk in a crowded mall
28 Take an escalator holding the rail
29 Take an escalator not holding the rail
30 Walk on icy sidewalks
31 Go to the store
32 Visit a friend or relative
33 Go out to a movie or show
34 Go to a community activity
35 Go to a doctor or dentist
36 Put up an umbrella and walk
37 Put up an umbrella and go shopping
38 Walk on snow
39 Snow removal from around the house
40 Snow removal from the roof

Concerning questions on activity self-efficacy, the subjects were interviewed as to whether they were ‘1. not confident’, ‘2. slightly lacking confidence’, ‘3. fairly confident’, or ‘4. very confident’. The movements measured were timed up and go test (TUG), times required for standing up from the floor, sitting on the floor, and going up and down a step, as well as forward, lateral, and downward movement times of the upper limbs in the standing position. In TUG, the subject stood up from an armchair, walked for 3 m, turned around, walked back, and sat again on the chair, and the time required for this movement was measured²³⁾. As for the time required for standing up from the floor, that required for standing up from the long sitting position to straight standing without holding onto any support was measured. Regarding the time required for sitting on the floor, that required to sit in the long sitting position from the straight standing position was measured. Concerning the time required for going up and down a step, that required to go up and down a 15-cm step without support one time was measured. In the measurement of forward, lateral, and downward movement times of the upper limbs in the standing position, an A/D converter (PC CARD, CONTEC) was connected to a PC (Panasonic), and the time required to turn a lamp from on to off was measured. The lamp was placed 50-cm anterior to the subject at a 80-cm level. The examiner manually lit the lamp, and the subject turned it off in the straight standing position. The subject turned off the switch with both hands in the forward, lateral, and downward directions. For the forward and lateral directions, the switch was placed at the subject's left acromial level, and the initial limb position was set at a 45° flexion of the elbow joint²⁹⁾. For the downward direction, the switch was placed at the subject's patellar level.

Association between the total score of activity self-efficacy and the items was investigated by

Spearman’s rank correlation analysis. Statistical analysis software, JMP 6.0.3, was used, and a p level lower than 5% was regarded as significant.

Results

Eighteen and 21 of the 44 subjects (41% and 48%, respectively) answered that they were very or slightly fearful of falling, respectively, and 16 subjects (36%) refrained from leaving the home due to fear of falling (Table 4).

A significant correlation was noted between activity self-efficacy and fear of falling ($r=0.417$, $p<0.01$). As for physical function items, TUG ($r=-0.324$, $p<0.05$), times required for going up and down a step ($r=-0.321$, $p<0.05$), and sitting down on the floor ($r=-0.365$, $p<0.05$), were significantly correlated (Table 5).

Discussion

For elderly women, falling is a serious problem because it has a psychological influence, such as activity restriction due to fear of falling, in addition to the reduction of physical function by fracture. The objective of this study was to verify the hypothesis: vertical downward movement from the standing position affects activities and motion restricted by fear of falling.

The activity self-efficacy investigated was significantly correlated with fear of falling,

showing that it reflects the fear level. On physical function measurement, the time required for going up and down a 15-cm step, and times required for sitting on the floor were correlated with self-efficacy, showing an association with vertical motion required for the traditional Japanese life-style. This may be demonstrating our hypothesis that vertical downward movement from the standing position affects activities and motion restricted by fear of falling.

Many studies elderly have reported an association of fear of falling with a reduction in motor function, such as lower limb muscle strength, balance, and gait speed¹⁶⁾⁻¹⁸⁾²⁴⁾. Binda et al.²⁵⁾ reported that fear of falling was more strongly associated with balance than muscle strength, and the ability to move the center of gravity forward and laterally is particularly important for balance. Robinovitch et al.

Table 4 Characteristics of participants

Falls in previous year	13 (29%)
Stumble/Trip in previous year	28 (63%)
Fear of falling	
Very fearful	18 (41%)
Moderately fearful	21 (48%)
Not fearful	5 (11%)
Fear and activity restriction	16 (36%)

Table 5 Correlation analysis of activity self-efficacy scale and items

	1	2	3	4	5	6	7
1 Activity self-efficacy scale (points)							
2 Movement time for forward (sec.)	-0.101						
3 Movement time for lateral (sec.)	-0.251	0.702**					
4 Movement time for downward (sec.)	-0.236	0.750**	0.524**				
5 Timed up and go test (sec.)	-0.324*	0.133	0.251	0.086			
6 Going up and down a 15-cm step (sec.)	-0.321*	0.136	0.2	0.125	0.873**		
7 Sitting on the floor (sec.)	-0.365*	-0.025	0.239	-0.043	0.846**	0.826**	
8 Standing up from the floor (sec.)	-0.28	0.055	0.114	0.047	0.795**	0.664**	0.606**

* p<0.05

** p<0.01

compared the forward and lateral movement times between elderly and young people, and found that the time required to move and touch a wall with the hands in response to a signal was significantly longer in the elderly²⁹⁾. We measured the vertical downward movement time in addition to the experiment reported by Robinovitch et al., but did not confirmed that vertical downward movement of the center of gravity affected fear of falling. Although there has been no previous study elderly Japanese that showed an association with floor-related movements and vertical downward reactivity, elderly people may change from a Japanese life-style to a western life-style when they become anxious for their personal safety. They inevitably change life-style when these movement and reactivity levels decrease, reducing the QOL. To perform normal daily activities with confidence, it is necessary to take measures to prevent the reduction of floor-related movements and vertical downward movement. As a background to our findings, there may be found the influence of knee joint pain and lower back pain. It may be said that it is one of the characteristics of the Japanese woman.

The regaining of confidence increases independence in daily activities in persons with fear of falling. To overcome an excessive fear of falling, improvement of physical skills to increase self-efficacy against falling is effective⁷⁾. Reduction of fear of falling by balance training in elderly people has been reported²⁶⁾⁻²⁸⁾. The increase in vertical downward movement by this study, in addition to improvement of physical skills, may strengthen the ability to avoid falling, resulting in increasing activity self-efficacy. The possibility of preparing a program to increase defensive vertical downward movement for the prevention and improvement of fear of falling was shown.

Conclusion

Activity self-efficacy was associated with

TUG, and times required for sitting on the floor, and going up and down a 15-cm from the standing position. These are essential maneuvers for sitting on the floor customary to the Japanese life-style. Preventing a reduction of vertical downward motion ability while standing may lead to the prevention and improvement of fear of falling, and its application in evaluation and intervention programs is expected.

Acknowledgement

We thank the subject people who cooperated with this investigation. We are especially grateful to Associate Professor Kazuhiro Terajima, Niigata University of Health and Welfare.

Reference

- 1) Tinetti ME, Powell L: Fear of falling and low self-efficacy: a case of dependence in elderly persons. *J Gerontol* 48: 35-38, 1993
- 2) Silverton R, Tideiksaar R: "Psychosocial aspects of falls: Its prevention and treatment", Springer, New York, pp 87-110, 1989
- 3) Cumming RG, Salkeld G, Thomas M, et al: Prospective study of the impact of fear of falling on activities of daily living, SF-36 scores, and nursing home admission. *J Gerontol A Biol Sci Med Sci* 55(5): M299-305, 2000
- 4) Arfken CL, Lach HW, Birge SJ, et al: The prevalence and correlates of fear of falling in elderly persons living in the community. *Am J Public Health* 84(4): 565-570, 1994
- 5) Howland J, Peterson EW, Levin WC, et al: Fear of falling among the community-dwelling elderly. *J Aging Health* 5(2): 229-243, 1993
- 6) Howland J, Lachman ME, Peterson EW, et al: Covariates of fear of falling and associated activity curtailment. *Gerontologist* 38(5): 549-555, 1998
- 7) Tinetti ME, Mendes de Leon CF, Doucette JT, et al: Fear of falling and fall-related

- efficacy in relationship to functioning among community-living elders. *J Gerontol* 49(3): M140-147, 1994
- 8) Walker JE, Howland J: Falls and fear of falling among elderly persons living in the community: occupational therapy interventions. *Am J Occup Ther* 45(2): 119-122, 1991
 - 9) Kondo S, Miyamae T, Tsutsumi F: Falls and fear of falling among the community-dwelling elderly. *Jpn J Occup Ther* 33: 839-844, 1999
 - 10) Suzuki M, Kanamori M, Yamada K: Incidence of, and factors related to, the fear of falling among the elderly living in their own homes. *Jpn J Geriatric Psychiatry* 10(6): 685-695, 1999
 - 11) Lachman ME, Howland J, Tennstedt S, et al: Fear of falling and activity restriction: The Survey of activities and fear of falling in the elderly(SAFE). *J Gerontol B Psychol Sci Soc Sci* 53(1): 43-50, 1998
 - 12) Yardley L, Smith H: A prospective study of the relationship between feared consequences of falling and avoidance of activity in community-living older people. *Gerontologist* 42(1): 17-23, 2002
 - 13) Murphy SL, Williams CS, Gill TM: Characteristics associated with fear of falling and activity restriction in community-living older persons. *J Am Geriatr Soc* 50(3): 516-520, 2002
 - 14) Friedman SM, Munoz B, West SK, et al: Falls and fear of falling: which comes first? A longitudinal prediction model suggests strategies for primary and secondary prevention. *J Am Geriatr Soc* 50(8): 1329-1335, 2002
 - 15) Bandura A: Self-efficacy mechanism in human agency. *Am Psychologist* 37(2): 122-147, 1992
 - 16) Maki BE, Holliday PJ, Topper AK: Fear of falling and postural performance in the elderly. *J Gerontol* 46(4): M123-131, 1991
 - 17) Lawrence RH, Tennstedt SL, Kasten LE, et al: Intensity and correlates of fear of falling and hurting oneself in the next year: baseline findings from a Roybal Center fear of falling intervention. *J Aging Health* 10(3): 267-286, 1998
 - 18) Fuzhong L, McAuley E, Fisher KJ, et al: Self-efficacy as a mediator between fear of falling and functional ability in the elderly. *J Aging Health* 14(4): 452-466, 2002
 - 19) Tinetti ME, Richman D, Powell L, et al: Falls efficacy as a measure of fear of falling. *J Gerontol* 45(6): 239-243, 1990
 - 20) Hill KD, Schwarz JA, Kalogeropoulos AJ, Gibson S: Fear of falling revisited. *Arch Phys Med Rehabil* 77: 1025-1029, 1996
 - 21) Powell LE, Myers AM: The Activities-specific Balance Confidence(ABC)Scale. *J Gerontol Med Sci* 50(1): M28-34, 1995
 - 22) Hotchkiss A, Fisher A, Robertson R, et al : Convergent and predictive validity of three scales related to falls in the elderly. *Am J Occup Ther* 58(1): 100-103, 2004
 - 23) Podsiadlo D, Richardson S : The timed "Up & Go": a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc* 39(2): 142-148, 1991
 - 24) Kim H, Yoshida H, Suzuki T, et al: The Relationship between Fall-related activity restriction and functional fitness in elderly women. *Jpn J Geriatr* 38: 805-811, 2001
 - 25) Binda SM, Culham EG, Brouwer B : Balance, muscle strength, and fear of falling in older adults. *Exp Aging Res* 29(2): 205-219, 2003
 - 26) Taggart HM : Effects of Tai Chi exercise on balance, functional mobility, and fear of falling among older women. *Appl Nurs Res* 15(4): 235-242, 2002
 - 27) Wolf SL, Barnhart HX, Kutner NG, et al: Reducing frailty and falls in older persons: an investigation of Tai Chi and computerized

balance training. Atlanta FICSIT Group.
Frailty and Injuries: Cooperative Studies of
Intervention Techniques. J Am Geriatr Soc
44(5): 489-497, 1996

- 28) Yates SM, Dunnagan TA: Evaluating the effectiveness of a home-based fall risk reduction program for rural community-dwelling older adults. J Gerontol A Biol Sci Med Sci 56(4): M226-230, 2001
- 29) Robinovitch SN, Normandin SC, Stotz P, Maurer JD: Time requirement for young and elderly women to move into a position for breaking a fall with outstretched hands. J Gerontol A Biol Sci Med Sci 60(12): 1553-1557, 2005

