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(在宅脳卒中患者における転倒効力感に関する研究)

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Falls Efficacy among Stroke Survivors Living in the Community

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Abstract

Purpose. The study focused on the falls efficacy of stroke survivors in the community and its association with the related factors.

Method. The study was conducted through a cross-sectional design in the community setting. One hundred and seven stroke survivors were recruited. Falls efficacy was measured by the 7-item Falls Efficacy Scale International version, where the higher mean score showed more concern about falling in daily life.

Results. Activities of daily living (ADLs) dependency levels, including mild, moderate and severe, contributed to 33.5% of the explained variance. Women were over 7.5 times more likely to have high falls efficacy than men. Moderate and severe ADLs dependency participants were 10.8 and 13.6 times more likely to have high falls efficacy than ADLs independent participants. Single fall participants were also nearly 13 times more likely to have high falls efficacy than others who had either recurrent falls or no falls.

Conclusions. Female gender, strong ADLs dependency, and single falls were associated with high falls efficacy. The levels of ADLs dependency were the most correlated with falls efficacy than with other related factors. Rehabilitation interventions should also be incorporated to minimize ADLs dependency, and to improve falls efficacy for stroke survivors.

Keyword: stroke, fear of falling, falls efficacy, activities of daily living

Introduction

Strokes are one of the most common neurological problems in community dwellers, and are also the leading cause of long-term disability [1]. It is very common for poststroke falls to occur within the first 6 months after a stroke. The incidences of poststroke fall have ranged from as low as 32% to as high as 73% [2-3]. Furthermore, recurrent falls have become common for stroke survivors: over 20% recurrent falls have been reported [4-6]. In a community-based study [7], 10.0% of single falls and 3.8 % of recurrent falls were reported in the elderly population in Taiwan. In another study [8], the risk of falling for stroke survivors in community-dwellings was two-fold compared to the rest of the regular population.

The risk factors related to falls for stroke survivors in the community have been closely studied. These potential risk factors included low levels of independence in activities of daily living [9-10], motor function deficits [4,11], balance impairment [6,9,12], falling history during hospitalization or rehabilitation [2,6], cognitive deficits, depression [2,4,8,6,10,13], and sensory impairment [11,14]. The more risk factors a stroke patient has, the higher probability that the survivor will suffer falls [15].

The most common side effect of poststroke falls was developing a fear of falling (FOF), which may lead to a limitation of activities of daily living [16-18], social deprivation [10], and more recurrent falls [2,16-18]. FOF is a general concept that describes a self efficacy of falls and being afraid of falling [19]. It is comprised of many factors with physical, psychological, and functional influences [19-20]. It is also known that the fear of falling may be developed after any falls for stroke patients [21], and it is worth mentioning that the fear of falling has been exhibited among both stroke patients who have experienced falls and those who have not [4]. Therefore, FOF for stroke survivors in the community may be a more pervasive problem than the falls themselves and deserves more attention. The study focused on the falls efficacy of stroke survivors in a community-dwelling setting, and also described the correlation of the efficacy with the related factors. One aim of this study was to determine the relationship between falls efficacy and fall related factors for stroke survivors. A further aim was to investigate the characteristics which distinguished between high and low falls efficacy groups.

Methods

Participants

One hundred and sixteen out-patients with confirmed strokes were enrolled in the study. 107 (92.2%) met the following criteria for inclusion: they lived at home or in a community setting, and were able to communicate with the researchers and understand the study instructions. Exclusion criteria was also set as: those patients with other concurrent neurologic disorders, a

Mini-Mental State Examination (MMSE) [22] score of less than 17, expression skills insufficient to provide required information, or the inability to complete the testing procedures. For participants suffered from aphasia, if he or she could not fill in the questionnaire or follow the researcher instructions, the participants would be excluded from the study. The study was conducted according to the tenets of the Declaration of Helsinki, and the study protocol has been approved by the institutional review board of Cheng-Hsin General Hospital in Taipei. Written informed consent was given and signed by all participants before they were enrolled in the study.

Design, procedure and materials

The study implemented a cross-sectional design. Two investigators were trained to perform the survey independently. After getting consent from each participant, a structured questionnaire was administered. All participants were encouraged to fill out the questionnaire by themselves, or otherwise they were assisted by investigators. The functional performance and balance examinations were also evaluated by the investigators. The period of time needed to complete study sessions ranged from 30 to 60 minutes.

Demographic characteristics and medical history such as date of stroke onset, stroke type, side of stroke, length of in-patient days in hospital, and comorbidities were included in the questionnaire. Stroke severity was evaluated using the National Institutes of Health Stroke Scale (NIHSS) [23]. The Barthel Index (BI) [24] was used to measure the level of activities of daily living (ADLs). BI scores between 0 and 60 indicated severe dependency on ADLs. Scores between 61 and 99 represented mild and moderate dependencies, and ADLs independencies had a BI score of 100. Balance assessments were measured with the balance subscale of the Fugl-Meyer Stroke Assessment Instrument (FMB) [25] and Sit-To-Stand (STS) test [26]. FMB is a 7-item test for assessment of balance while sitting and standing, with a 3-point scale (0-2) for each item. FMB provides a total score range from 0 to 14 for each individually tested patient. STS is the measured timing of sit-to-stand with a self-paced speed. Stroke fallers typically showed a worse performance than nonfallers in the STS test (4.3 sec *v.s.* 2.7 sec, $p < .005$) [26]. Therefore, a STS score of more or less than 3 seconds was the critical index in the study.

Falling history included the number of falls in the previous year or since the stroke onset if less than a year. For fear of falling, the 7-item Falls Efficacy Scale International version (*7-item FES-I*), a self-efficacy questionnaire developed by Yardley and coworkers [27-28], based on the original FES-I (16-item), was used. The 7-item FES-I measures how concerned a stroke individual is with the possibility of falling in daily life activities. Each item has a point range of 1 to 4 (1 = not concerned at all to 4

= very concerned) and a total score of 7 to 28 points for 7 items. A higher score indicates more concern about falling. The 7-item FES-I has as good validation as the 16-item FES-I, but shows more feasibility in assessing the fear of falling for older people [29].

Statistical analysis

Participants were categorized into 2 groups, low and high falls efficacy, grouped by the 7-item FES-I assessment with scores of 7-14 and 15-28 respectively. Group differences were analyzed by chi-square tests of Univariate analysis. The adjusted odds ratios with a 95% confidence interval (95% CI) were estimated by multiple logistic regression models with the predictive risk factors. Linear multiple regressions were performed for the analyses of the predictive effects between the related factors and the outcome variables. The level of statistical significance was set at $p < 0.05$ for all tests. All data was statistically analyzed with the Statistical Package of Social Sciences (SPSS) for Windows (Version 13.0).

Results

Participant demographics and functional statuses are shown in Table 1. Sixty-nine (64.5%) male and thirty-eight (35.5%) female participants, with a mean age of 67.8 years old, were included in the study. 44 (41.1%) participants were divided into groups of dependence in ADLs assessment (with the Barthel index in a severity range of 0-60, or mild and moderate 61-99 scores). 47 (43.9%) participants showed STS over 3 seconds. Over half of the participants had lower scores (FMB ≤ 10), showing that the patients were not physically well-balanced. 29 (27%) of the participants met the NIHSS score (≥ 7) of the severity. 56 (52.3%) participants had fallen in the previous year, and among them, 21 (19.6%) participants had a single fall and 35 (32.7%) experienced recurrent falls.

Table 1. Characteristics of the participants

n=107

Variable	n (%)
Age ≥ 60 y	82 (76.6)
Female gender	38 (35.5)
Time since onset(mo) ≥ 12 m	63 (58.1)
Stroke type Hemorrhage	16 (15.0)
Length of in-patient days > 7 days	64 (59.8)
NIH stroke scale ≥ 7	29 (27.1)
Barthel index	
61-99	18 (16.8)
0-60	26 (24.3)
STS ≥ 3 sec	47 (43.9)
FMB ≤ 10	63 (58.9)
Falling history	
≥2 falls	35 (32.7)
1 fall	21 (19.6)
7-item FES-I	
High falls efficacy (15-28)	74 (69.2)

STS = sit-to-stand test

FMB = Fugal-Meyer stroke assessment balance instrument

7-item FES-I = 7-item falls efficacy scale international version

In Table 2, multiple linear regression analysis is utilized in 3 models for the related factors and fall-efficacy scale. In model 1, total ADLs dependency levels, including mild, moderate and severe, showed the unique contribution for 33.5% of the explained variance ($p < 0.001$). Single fall ($p = 0.004$) and recurrent falls ($p = 0.020$) are added in model 2, and contributed to 5.1% of the adjusted R square change. In model 3, a total of 49.6% of the explained variance was shown, including ADLs dependency levels, falling history, female gender, age, NIHSS, STS, and FMB. Mild and moderate ADLs dependency ($p = 0.001$), severe ADLs dependency ($p = 0.005$), single fall ($p = 0.001$) and female gender ($p = 0.003$) were the main factors to the 7-item FES-I score.

Table 2. Multiple linear regression analysis between the related factors and falls efficacy

n=107

	7-item FES-I		
	Model 1 β (95% CI)	Model 2 β (95% CI)	Model 3 β (95% CI)
ADLs level dependency			
Mild and moderate dependency *vs.* independency	8.13(5.23-11.02)	7.26(4.24-10.30)	5.52(2.39-8.65)
Severe dependency *vs.* independency	10.35(7.04-13.67)	8.43(4.92-11.94)	5.41(1.66-9.16)
Falling history			
Single fall *vs.* others[a]		4.70(1.54- 7.86)	4.87(1.99-7.74)
Recurrent falls *vs.* others[b]		3.56(0.58- 6.55)	1.78(-1.11-4.67)
Female gender			3.65(1.28-6.03)
Age			0.09(-0.02-0.20)
NIH stroke scale ≥ 7			-0.03(-2.84-2.76)
STS ≥ 3 sec			2.96(-0.62-6.54)
FMB ≤ 10			-0.72(-3.78-2.34)
Adjusted R square	33.5	38.6	49.6

[a] no fall and recurrent falls; [b] no fall and single fall

STS = sit-to-stand test

FMB = Fugal-Meyer stroke assessment balance instrument

7-item FES-I = 7-item falls efficacy scale international version

As Table 3 shows, there were significant differences between the two groups of 7-item FES-I because of gender, in-patient days, NIHSS, ADLs dependency levels, STS, and falling history. Table 3 also summarized the risk factors of 7-item FES-I

through multivariate analysis. Using multiple stepwise logistic regression model, women were over 7.5 times more likely to have high falls efficacy than men (95% CI, 1.95-28.98). Moderate and severe ADLs dependency participants were 10.8 (95% CI, 1.03-112.93) and 13.6 (95% CI, 2.35-78.50) times more likely to have high falls efficacy than ADLs independent participants. Single fall participants were also nearly 13 times more likely to have high falls efficacy than others who had either recurrent falls or no fall.

Table 3. OR (95% CI) for the related factors with low and high falls efficacy n=107

	High falls efficacy (n=74)	Low falls efficacy (n=33)	Univariate analysis OR(95% CI)	Multivariate analysis OR(95% CI)
Female gender	34	4	6.16 (1.97- 19.29)	7.52 (1.95- 28.98)
Length of in-patient days > 7 days	50	14	2.92 (1.24- 6.90)	
NIH stroke scale ≥ 7	25	4	3.70 (1.17- 11.70)	
Mild and moderate dependency	17	1	15.46 (1.94-123.27)	13.57 (2.35- 78.50)
Severe dependency	24	2	9.61 (2.37- 50.12)	10.79 (1.03-112.93)
STS ≥ 3 sec	43	4	10.06 (3.21- 31.53)	
FMB ≤ 10	51	12	3.88 (1.64- 9.17)	
Single fall	18	3	6.24 (1.63- 23.83)	12.93 (2.39- 69.89)
Recurrent falls	31	4	8.06 (2.48- 26.16)	2.03 (0.45- 9.13)

High falls efficacy = 7-item FES-I values above or at 15; Low falls efficacy = 7-item FES-I values below 15

STS = sit-to-stand test

FMB = Fugal-Meyer stroke assessment balance instrument

Discussion

The selected sample of stroke survivors in the study might not be regarded as representative of all stroke patients. We decided to exclude the patients with severe cognitive impairment [30] when considering the limitations to completing the designed questionnaires. As mentioned, the study focused on determining the correlation between the falls efficacy and the related factors for a sample of stroke survivors in a community setting. Female gender, ADLs dependency levels, and falling history were correlated with the falls efficacy. The overall fall rate of our sample in community-dwelling settings was 52.3%. This rate was lower than the rates of 70% [21] and 73% [2] reported by two studies for people who have had strokes, but it was higher than the rate of 13.8% reported for the elderly in community-dwelling settings in Taiwan [7]. The recurrent falls rate of the

sample was 32.7%, which was higher than the rates of 21.8% [6], 22% [5] and 24% [4] in other studies regarding stroke survivors.

In the study, 78 (72.9%) participants reported that they were "afraid of falling", and the study showed that they were 4.2 times (95% CI, 1.65-10.68) more likely to have a fall or multiple falls than people who reported that they were "not afraid of falling." In the high falls efficacy group, 74 (69.1%) participants were 7.28 times (95% CI, 2.78-19.08) more likely to have a fall or multiple falls than people who were in low falls efficacy. Belgen *et al* [5] found that people who had experienced chronic strokes and who reported that they were"afraid of falling" were 2.36 times more likely to have a fall or multiple falls, while in Andersson *et al*'s study [31], the high falls self-efficacy group was more than 5 times likely to have a fall or multiple falls. It revealed that falls efficacy was more correlated to the falling history of stroke survivors in community-dwelling settings.

In a qualitative study, three important factors were reported to be possibly correlated with poststroke fear of falling, including the initial fall coinciding with the stroke onset, the perception of poststroke body changes, and a pervasive everyday fear of future falls [3]. Some fall-related factors have been studied, and the results demonstrated the factors had a significant correlation with falls efficacy, including balance ability [5,10,32-34], gait velocity [33], ADLs [31,35], and falling history [5,10,16,31]. It should be noticed that single falls were shown to be statistically more correlated with falls efficacy than recurrent falls were. Similar results were also reported in Belgen and worker's study [5], although multiple fallers showed less influence on falls efficacy than those of non- or single fallers. In the study, there was no difference between high and low falls efficacy in stroke type, infarction or hemorrhage. However it should be noticed that because most of these infarction stroke survivors were taking anticoagulants, like warfarin, the consequences of falls could be serious [36]. It is possible the falls could cause these patients to be more fearful of falling. At present, there is no study about the relationship between anticoagulants and falls efficacy, and it may be an issue of concern in the future.

The levels of ADLs dependency showed the most significant correlation with falls efficacy than with any other related factors in the study. In univariate analysis, high falls efficacy was significantly associated with female gender, long in-patient days, elevated stroke severity, high dependency of ADLs, balance impairment and previous fall history. However, in multivariate analysis, only female gender, mild and moderate dependency on ADLs, severe dependency on ADLs, and single falls were significantly associated with high falls efficacy. There were no significant differences in stroke severity, balance measures and recurrent falls between those who had high or low falls efficacy. Similar results were also

reported in another study and only earlier falls and physical functions remained significant in stroke patients determined by multivariate analysis [31]. The level of ADLs dependency might show more dominant influence than stroke severity or balance ability on falls efficacy. BI score could be used to measure and predict the ADLs disabilities and stroke severity in the first 6 months for stroke patients [37]. BI score also had a significant correlation with the skill level of basic activities related to standing [34,37]. Thus, in the study, the association of the related factors, such as stroke severity and balance impairment, to the responsiveness on falls efficacy was weakened. Comparatively, in Hellstrom *et al's* study [32], falls efficacy was a more powerful predictor of ADLs than balance measures. More cohort studies should be taken to determine the cause and effect between ADLs and falls efficacy. Rehabilitation interventions should also be incorporated to minimize ADLs dependency, and to improve falls efficacy for stroke survivors in community-dwelling settings.

Conclusion

The study found that stroke survivors with higher falls efficacy had distinct characteristics. Female gender, ADLs dependency, and single fall experience exhibited higher falls efficacy than other stroke survivors in the community. The level of ADLs dependency showed the most significant correlation with falls efficacy amongst all related factors in the study. It also revealed that falls efficacy was more influential than whether or not the person was "afraid of falling", indicating the correlation of falls efficacy and falling history of stroke survivors in the community. Additional prospective studies should be undertaken in the future to determine the correlation between falls efficacy, falling history, and other related factors for this group.

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