



Original Article

Measurement of balance function and community participation in stroke survivors

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Abstract. [Purpose] This study aimed to investigate the relationship between balance function and community participation in stroke survivors. [Subjects and Methods] Sixty-three patients diagnosed with hemiparetic stroke participated in this study (36 males, 27 females, aged 58.6 ± 15.2 years). The participants were assessed for balance function and their level of participation in the community, using activity card sorting and the Berg Balance Scale. A regression analysis was used to identify the influence of balance function on instrumental activities of daily living and leisure and social activities. [Results] The results of the regression analysis indicated that balance function measured by using the Berg Balance Scale affected community participation of patients with hemiparetic stroke. Participation in instrumental activities of daily living and leisure and social activities was affected by balance function. [Conclusion] This study provides useful information for designing efficient programs and identifying their effectiveness for enhancement of community participation in stroke survivors.

Key words: Balance, Participation, Stroke

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INTRODUCTION

Of patients who survive a stroke, 39% report ongoing problems with independent participation in community activities¹⁾. This limitation in community participation has been identified as one of the most debilitating consequences of a stroke. Only 50% of stroke survivors regain the ability to walk in the community^{2, 3)}. Most stroke survivors have impaired cognitive and motor ability⁴⁾. These patients have difficulty participating at work, home, and in the community, due to impaired balance function or motor ability⁵⁾. Balance function is necessary to most stroke patients for independent living in the community and performing associated tasks⁶⁾.

Based on the conceptual framework of the International Classification of Functioning, Disability and Health (ICF), participation is considered a highly complex function⁷⁾. A recent study reported various factors that affect community participation of patients with stroke⁸⁾. Despite various assessment tools reported in the literature, there is a lack of studies on the relationship between specific balance function and community participation. There are several assessment tools to measure balance function, including the Berg Balance Scale (BBS), which is the most commonly used assessment tool across the continuum of stroke rehabilitation. The BBS is an objective measure of balance abilities, and measures both static and dynamic aspects of balance⁹⁾. The test has also been used to identify and evaluate balance impairment in the elderly.

A previous study suggested that the BBS has strong reliability, validity, and responsiveness to change. Furthermore, the test is easy to administer without the need for expensive equipment or prolonged assessment time¹⁰⁾. It has excellent predictive validity for important outcomes such as discharge disposition^{9, 10)}. This study aimed to develop an appropriate treatment plan for specific balance function, in order to enhance community participation in patients with hemiparetic stroke.

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Table 1. Demographic characteristics of subjects (N=63)

Characteristic		Subjects
Gender	Male	36
	Female	27
Age (years)		58.6 (20–96)
Etiology	Hemorrhage	22
	Infarction	41
Affected side	Right	17
	Left	46
Onset period (months)		33.4 (1–160)
MMSE-K		26.4 (19–30)
K-ACS(%)	IADL	45.9 ± 39.3
	Leisure participation	70.7 ± 57.5
	Social participation	54.0 ± 29.5
BBS*		24.8 ± 16.1

Data are mean (range), mean ± standard deviation

*Total score of BBS

SUBJECTS AND METHODS

Sixty-three patients with hemiparetic stroke participated in this study. The inclusion criteria were as follows: (1) diagnosis of stroke, with onset 1 month or more before the study; (2) adult living in the community; (3) 19 or more points on the Mini-Mental State Examination-Korean version (MMSE-K) and (4) absence of hearing impairment. All participants were informed of the purpose and procedures of this study, and signed a consent form. The local institutional review board approved the study.

This study evaluated 3 clinical measurement tools, including the BBS and Korean-Activity Card Sorting (K-ACS), following standardized administration methods in a calm and organized therapy room. The MMSE-K is used to select participants who can perform cognitive functions, according to a previous study targeting normal cognitive function in stroke patients.

The BBS is used to assess static and dynamic balance ability in adults. The test is designed around a 14-item objective measure, with the score for each item ranging from 0–4. Scores are determined by the participant's ability to perform the assessed activity. The item scores are summed and the maximum score is 56⁽¹¹⁾. The BBS has strong reliability and validity, and the test is useful and easy to use in the clinic. The K-ACS, which is picture-based, examines the occupational participation level, and gathers information on social, instrumental, and leisure activities. The assessment tool is composed of photographs depicting the performance of various activities in several different environments. The tool is reported to have excellent criterion validity in chronic stroke⁽¹²⁾. This study analyzed the specific items on the BBS and K-ACS. The dependent variables were the specific items on the K-ACS and the independent variables were the specific items on the BBS.

This study used assumptions for regression analysis to investigate the relationship between participation and specific balance functions. SPSS for Windows version 17.0 (SPSS Inc., Chicago, IL, USA) was used for data analysis. The statistical significance level was set at $p < 0.05$.

RESULTS

Sixty-three patients with stroke participated in this study (36 males, 27 females, and aged 58.6 ± 15.2 years). [Table 1](#) lists the demographic characteristics of the study participants. The results of the regression analysis indicated that specific balance functions affect community participation in stroke patients. The BBS results showed that the action with the greatest effect on community participation on the K-ACS is standing with one foot in front of the other ([Table 2](#)).

DISCUSSION

In this study, we aimed to provide appropriate treatment plans for specific balance function, in order to enhance community participation in patients with hemiparetic stroke. The results of the regression analysis indicated that balance function affected participation in IADLs and leisure and social activities in the community among patients with hemiparetic stroke.

The BBS is the most common test used to assess postural control in daily living in people with stroke. The BBS is a representative tool for fall prediction in the elderly, and measures balance ability. This tool is widely used, it is objective and reliable, and is able to evaluate overall and item-by-item static and dynamic balance abilities^(13, 14). In other words, participa-

Table 2. Results for factors influencing participation after stroke

Dependent variable (K-ACS)	Independent variable (BBS)	R ²	B	Standard error
IADL	Standing with eyes closed	0.477	23.752	8.174*
	Standing with one foot in front		38.049	12.729*
Leisure participation	Standing on one foot	0.348	-46.249	20.424*
	Standing with one foot in front		56.658	20.789*
Social participation	Reaching	0.459	11.770	5.759*
	Standing with eyes closed		18.789	6.253*
	Standing with one foot in front		30.296	9.736*

*p<0.05

tion in IADLs was correlated with perceptual and cognitive function, and participation in leisure and social activities was affected at an independent level. Therefore, this study statistically evaluated the correlation between participation and skills for daily living at an independent level.

Standing with one foot in front of the other was the specific balance function that most affected participation in IADLs and leisure and social activities. This measurement requires the participant to place one foot directly in front of the other, with the feet in tandem, and hold the position for 30 seconds¹¹). This balance function requires higher equilibrium and balance skills. Higher balance skills are used automatically for participation in IADLs and leisure and social activities in the community. Therefore, stroke rehabilitation should emphasize this specific balance function.

Limitations of this study are as follows. First, the number of participants was too small to generalize the results to a larger population of patients with stroke. Second, this study did not consider sensory or language function impairments associated with stroke. Further studies with more participants are necessary to evaluate various factors affecting community participation.

Nevertheless, the results of this study provide useful information for designing efficient programs and identifying their effectiveness for enhancement of community participation in patients with stroke.

REFERENCES

- 1) Mayo NE, Wood-Dauphinee S, Côté R, et al.: Activity, participation, and quality of life 6 months poststroke. *Arch Phys Med Rehabil*, 2002, 83: 1035–1042. [[Medline](#)] [[CrossRef](#)]
- 2) Pound P, Gompertz P, Ebrahim S: A patient-centred study of the consequences of stroke. *Clin Rehabil*, 1998, 12: 338–347. [[Medline](#)] [[CrossRef](#)]
- 3) Lord SE, McPherson K, McNaughton HK, et al.: Community ambulation after stroke: how important and obtainable is it and what measures appear predictive? *Arch Phys Med Rehabil*, 2004, 85: 234–239. [[Medline](#)] [[CrossRef](#)]
- 4) Go AS, Mozaffarian D, Roger VL, et al. American Heart Association Statistics Committee and Stroke Statistics Subcommittee: Heart disease and stroke statistics—2013 update: a report from the American Heart Association. *Circulation*, 2013, 127: e6–e245. [[Medline](#)] [[CrossRef](#)]
- 5) Sansonetti D, Hoffmann T: Cognitive assessment across the continuum of care: the importance of occupational performance-based assessment for individuals post-stroke and traumatic brain injury. *Aust Occup Ther J*, 2013, 60: 334–342. [[Medline](#)]
- 6) Bennie S, Bruner K, Dizon A, et al.: Measurements of balance: comparison of the timed “Up and Go” test and functional reach test with the berg balance scale. *J Phys Ther Sci*, 2003, 15: 93–97. [[CrossRef](#)]
- 7) Silva SM, Corrêa FI, Faria CD, et al.: Psychometric properties of the stroke specific quality of life scale for the assessment of participation in stroke survivors using the rasch model: a preliminary study. *J Phys Ther Sci*, 2015, 27: 389–392. [[Medline](#)] [[CrossRef](#)]
- 8) Kramer SF, Churilov L, Kroeders R, et al.: Changes in activity levels in the first month after stroke. *J Phys Ther Sci*, 2013, 25: 599–604. [[Medline](#)] [[CrossRef](#)]
- 9) Harris JE, Eng JJ, Marigold DS, et al.: Relationship of balance and mobility to fall incidence in people with chronic stroke. *Phys Ther*, 2005, 85: 150–158. [[Medline](#)]
- 10) Andersson AG, Kamwendo K, Seiger A, et al.: How to identify potential fallers in a stroke unit: validity indexes of 4 test methods. *J Rehabil Med*, 2006, 38: 186–191. [[Medline](#)] [[CrossRef](#)]
- 11) Berg K, Wood-Dauphinee SL, Williams JI, et al.: Measuring balance in the elderly: preliminary development of an instrument. *Physiother Can*, 1989, 41: 304–311. [[CrossRef](#)]
- 12) Baum CM, Edward D: *Activity Card Sort*. St. Louis: Washington University School of Medicine, 2001.
- 13) Bogle Thorbahn LD, Newton RA: Use of the Berg Balance Test to predict falls in elderly persons. *Phys Ther*, 1996, 76: 576–583, discussion 584–585. [[Medline](#)]
- 14) Berg KO, Maki BE, Williams JI, et al.: Clinical and laboratory measures of postural balance in an elderly population. *Arch Phys Med Rehabil*, 1992, 73: 1073–1080. [[Medline](#)]