



Original Article

The sensitivity and specificity of the Falls Efficacy Scale and the Activities-specific Balance Confidence Scale for hemiplegic stroke patients

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Abstract. [Purpose] This study attempted to investigate the sensitivity and specificity of the Falls Efficacy Scale (FES) and the Activities-Specific Balance Confidence Scale (ABC) for community residents with hemiplegic stroke. [Subjects and Methods] The FES and the ABC data were collected for a sample of 99 community-dwelling hemiplegic stroke patients in Korea. The Receiver Operating Characteristic (ROC) curve was used to determine the cut-off values, and the area under the curve (AUC) was used to assess the overall accuracy of each balance test. Multivariate logistic regression analysis was employed to identify the predictors of falling. [Results] The cut-off value was 63.75 in the ABC and 66.50 in the FES. The sensitivity and specificity of the ABC was 41.3% and 92.0%, respectively. The sensitivity and specificity of the FES was 69.8% and 63.9%, respectively. The AUC was 0.691 for the ABC and 0.678 for the FES. The ABC explained 28.0% of the variance in the experience of falls. [Conclusion] The ABC has the ability to determine non-fallers, and it was a good explanatory factor of experience of falls.

Key words: Activities-Specific Balance Confidence Scale, Falls Efficacy Scale, Stroke

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INTRODUCTION

Stroke survivors have been reported to have a high risk of falls¹⁾. Falls are the cause of serious complication after stroke²⁾, and about one-third of hospital-related falls lead to potentially serious injuries such as fractures³⁾. Falls by stroke patients have additional effects on rehabilitation outcomes and functional recovery⁴⁾. Because of the extreme cost both to the patient and to society, prevention of falls by stroke patients is a major rehabilitation goal.

Falls by stroke patients are caused by physical factors as well as psychological factors. The representative psychological factor is fall related self-efficacy. The concept of self-efficacy was introduced by Bandura and is considered an important motivator of human behavior⁵⁾. It affects a patient's ability to organize and execute different types of activities, and influences decisions regarding whether to engage in or avoid particular activities or settings. Falls efficacy has been found to moderately correlate with activities of daily living performance, balance, and cognition⁶⁾. Rehabilitation for individuals with stroke concentrates on improvement of physical function and mental function and item, such as self-efficacy have received less attention⁷⁾. Self-efficacy is a psychological characteristic that has received great attention in the management of various chronic diseases⁸⁾.

The tools used to assess fall-related self-efficacy are the Falls Efficacy Scale (FES) and the Activities-specific Balance Confidence Scale (ABC). The Falls Efficacy Scale (FES) was developed by Tinetti et al.⁹⁾, and is one of the instruments based on the theory of self-efficacy. The ABC was developed to assess in clinical practice balance confidence of older adults¹⁰⁾.

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Program for preventing falls are usually performed. Although the specific content of interventions proposed for fall prevention depend on the patient population, the initial step of these programs is fall-risk assessment to identify the persons who have high risk of falls¹¹). Despite various fall-risk assessment tools have been reported in the literature, there is a lack of comparison between the tools used to assess the psychological factors of falling. The purpose of this study was to compare the accuracy of the FES and the ABC in identifying fallers versus non-fallers among stroke patients.

SUBJECTS AND METHODS

The study sample was composed of 99 community-dwelling hemiplegic stroke patients who visited a convalescence or rehabilitation center for disabled individuals in South Korea. Their mean time after stroke was 97.62 months and the mean time since discharge was 61.69 months. Subjects who scored less than 18 points on the Korean version of the Mini Mental State Examination (MMSE-K) were excluded from this study. Study approval was received from the Ethics Review Board of Jeonju University, and written informed consent was obtained from all of the participants. The interviews were carried out by trained registered physical therapists. There were 35 fallers and 64 non-fallers. The mean age of fallers was 64.83 (SD=9.76) years, and the mean age of non-fallers was 62.83 (SD=8.64) years. The mean K-MMSE score of the fallers was 23.43 (SD=5.93), and non-fallers had a mean K-MMSE score of 24.49 (SD=5.10).

The Activities-specific Balance Confidence Scale was developed to assess the balance confidence of older adults¹⁰). The Korean version of the ABC Scale, a 16-item questionnaire that rates confidence from 0% (no confidence) to 100% (very confident), was implemented. Averaging the ratings derives the total score, and higher scores reflect higher levels of balance confidence. The ABC scale has been used with various populations, including older adults with stroke¹²).

The Korean FES was used for measuring fall self-efficacy¹³). Ten items are scored using a 10-point ordinal scale with a total possible score of 100 points. The Korean FES items are: (1) take a bath or shower, (2) reach up to a closet, (3) do light housekeeping (e.g., clean up your nightstand or dresser), (4) walk around the nursing home, (5) get in and out of bed, (6) get up at night to go to the bathroom, (7) get in and out of a chair, (8) get dressed and undressed, (9) do personal grooming (e.g., wash your face, comb your hair), and (10) get on and off the toilet. The assessments were performed by trained registered physical therapists.

The Receiver Operating Characteristic (ROC) curve was used to determine the cut-off values for the ABC and the FES. The overall accuracy of each balance test was assessed using the area under the curve (AUC). The AUC indicates the probability that a stroke patient who is a faller will be correctly identified. Multivariate logistic regression analysis was employed to identify the predictors of falls among the stroke patients.

RESULTS

Table 1 shows the cut-off values of the ABC and the FES. The cut-off value was 63.75 for the ABC and 66.50 for the FES. The sensitivity and specificity of the ABC was 41.3% and 92.0%, respectively. The sensitivity and specificity of the FES was 69.8% and 63.9%, respectively. The AUC was 0.691 for the ABC and 0.678 for the FES.

The multivariate logistic regression analysis showed that the ABC score was a significant predictor of falls. Details of the results are presented in Table 2.

DISCUSSION

Falls by stroke patients occur very frequently, and hence, a fall risk assessment scale was developed. It was an important aspect of fall-risk assessment that physical factors as well as psychological factors affect falling¹⁴). One psychosocial factor is the fear of falling and another is balance self-efficacy. Psychological factors of falling should be measured using a self-report tool. Although psychological factor of falling is one aspect of falling, few studies have compared it with the self-report tool. The objective of this study was to summarize information regarding existing fall assessment scales based on self-efficacy so that clinicians can make more informed choices.

Sensitivity and specificity are commonly used in order to assess the accuracy of test measures with dichotomous results. These indicators show how well the condition can be distinguished. Sensitivity measures the proportion of positives that are correctly identified, i.e. the proportion of sick people who are correctly identified as having the condition, and specificity measures the proportion of negatives that are correctly identified, i.e. the percentage of healthy people who are correctly identified as not having the condition. The specificity and sensitivity of the FES was low, but the specificity of the ABC was high in this study. The results of the logistic regression analysis showed that the ABC score was a significant explanatory variable. This means that the ABC has a good ability to identify persons who will not fall and its use should be considered for predicting fallers.

The ROC curve for determining is a fundamental tool for diagnostic test evaluation. It allows the creation of a complete sensitivity and specificity report for determining the cut-off point of the test¹⁵). The graphical plot of sensitivity versus 1-Specificity is called the receiver operating characteristic (ROC) curve, and the area under the curve (AUC) is a measure of how well a parameter can distinguish between two diagnostic groups. It is considered to be an effective measure of accuracy

Table 1. Cut-off value, AUC, sensitivity, and specificity

Variable	Cut-off value	AUC	Sensitivity (%)	Specificity (%)
ABC	63.750	0.691	41.3	92.0
FES	66.500	0.678	69.8	63.9

AUC: area under the curve

Table 2. The results of multivariate logistic regression

Category	B	SE	OR	p	R ²
ABC	0.045	0.015	1.047	0.002	0.280
Intercept	-1.444	0.731	0.236	0.048	

with a meaningful interpretation¹⁶). The cut-off point for the FES was 66.50 and the cut-off point for the ABC was 63.75. This cut-off point, which indicates the possibility of future falls, was higher than that reported by previous studies. The high cut-off point of this study might be due to characteristics of the subjects of this study, hemiplegic stroke patients. In AUC analysis, from 0.5 means that the results of the test are due to chance, from 0.5 to 0.7 that the result indicates low accuracy, from 0.7 to 0.9 that the result has moderate accuracy, and 1.0 that the test has perfect accuracy¹⁷). The accuracy of the FES and the ABC was more than 0.5 which is not a high score. The AUC score was affected by previous fall experience, because this study was performed retrospectively. Careful interpretation of the AUC is needed.

In summary, the results of the comparison of the FES and the ABC with respect to their abilities to determine fallers among hemiplegic stroke patients show that the ABC has the ability to determine non-fallers. Also, the ABC was good explanatory factor of the experience of falls. Both the FES and the ABC had low accuracy. The results of this study suggest that comprehensive evaluation should be performed for the prediction of falls by stroke patients. This study had some limitations because of its retrospective and cross-sectional design. Prospective and follow-up studies should be performed to determine the accuracy of psychological factors related to falls by stroke patients.

Conflict of interest

None.

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