



Original Article

Perception and use of balance measures for stroke patients among physical therapists in South Korea

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Abstract. [Purpose] The purpose of this study looked into physical therapists' perception and use of balance measures for stroke patients. [Subjects and Methods] Three hundred eighty two physical therapists who understood the purpose of this study, agreed on their participation in this study, were treating or treated stroke patients. A Cross-sectional study based on self-administered questionnaire that had a total of 41 questions was performed in South Korea. 382 questionnaires were used for analysis. [Results] Regarding the questions about their perception and of personal measures, 287 persons (75.1%) replied that Single Leg Stance test was the most useful. According to the data analysis on their use of balance measures, Single Leg Stance Test was used by 254 persons (66.5%, the highest percentage), Functional Reach Test by 199 (52.1%). Also, stepwise multiple regression analysis was conducted. As a result, the most influential factor was physical therapists' perception of personal measures, and their use was also influenced by their comprehensive perception of measurement and their perception of balance factors. [Conclusion] This study revealed physical therapists' perception and use of balance measures for stroke patients and showed that their perception of balance measures for stroke patients affected their use of personal measures.

Key words: Stroke, Balance, Measurement

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INTRODUCTION

A stroke or cerebrovascular accident (CVA) shows impairments and various disabilities in motor, sensory, mental, perception and language functions¹⁾. The balance problem after stroke is a general symptom and negatively affects activities of daily living and walking recovery and increases the risk of fall^{2, 3)}.

Balance is defined as the ability to maintain a position within the limits of stability or base of support. Postural control can be defined as the act of maintaining, achieving or restoring a state of balance during any posture or activity^{4, 5)}.

The balance assessment for stroke patients is important, for it is required to set up an objective of treatment, to determine a treatment method, and suggest progression and prognosis^{6, 7)}. In addition, using objective balance measurement tools is important for evidence-based practice in order to improve balance ability⁸⁾.

As methods of measuring balance ability, there are functional performance tests including Romberg test, Single-Leg Stance test, Step test, Functional Reach test, and TUG (timed up & go) test; ordinal scale measures, such as BBS (Berg balance scale), PASS (postural assessment scale for stroke patients), ABC (activities-specific balance confidence) scale, MAS (motor assessment scale), TIS (trunk impairment scale), BBA (Brunel balance assessment), and FMA (balance section of the Fugl-Meyer assessment); and instrumented measurement tools to measure postural sway, weight distribution, and the ability to postural control^{4, 5, 9–11)}.

However, numerous measurement tools have been used for the purpose of research or the purpose of clinical assess-

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ment¹²). Therefore, it is hard for physical therapists to apply the balance measures suitable to patients' functional level to clinical practice. According to the research by Park Hye-jeong¹³), there are difficulties with the use of measurement tools as follows: first, the clinical setting where many patients need to be treated in a limited treatment time is improper to use measurement tools; secondly, if measurement tools are used for assessment, it is impossible to request medical insurance fee for each measurement tool in the current medical insurance cost system; thirdly, there is a lack of education or educational opportunities of assessment in attendance at or after graduation from college, university, and graduate school¹³). Berg Balance Scale, one of the most popular and recognized balance measures for stroke patients in terms of reliability and validity, has also floor & ceiling effect so that it is hard to measure all stroke patients' balance ability only with Berg Balance scale¹⁴). Instrumented measurement tools also have limited subjects and are too expensive¹¹).

Regarding the issue, Tyson and Connell¹⁵) suggested Romberg test, Single-Leg Stance test, Forward reach test, Arm raise test, Step/Tap test, Timed "Up & Go" test, Brunel Balance Assessment, Berg Balance Scale, Motor Assessment Scale, and Trunk Impairment Scale as the measurement tools suitable to the aspect of psychometrics related to reliability and validity, and the aspect of clinical utility related to measurement time, measurement cost, and simplicity of the application of measurement tools¹⁵). To supplement floor & ceiling effect of Berg Balance Scale, Blum and Korner-Bitensky¹⁴) additionally performed other measurement tools such as PASS and ABC scale to measure patients according to their functional level¹⁴) and instrumented measurement tools were able to obtain the most objective information despite their disadvantages of limited subjects and high cost¹¹).

Therefore, this study looked into physical therapists' perception and use of balance measures for stroke patients, surveyed the relative element affecting their use, and thereby provided a fundamental material to apply an effective balance measure in balance assessment for stroke patients.

SUBJECTS AND METHODS

This researcher first surveyed a list of tertiary hospitals, general hospitals, standard hospitals, care hospitals, and health care centers, and then extracted the hospitals to look into randomly. In the hospitals, physical therapists who understood the purpose of this study, agreed on their participation in this study, were treating or treated stroke patients were chosen as study subjects.

A questionnaire was designed in May, 2014 after literate research. In June of the same year, after preliminary survey with 16 physical therapists, the questionnaire was changed, supplemented, and completed. On June 26, 2014, the questionnaire ended up being approved by Ethics Committee of Sahmyook University (SYUIRB2014-070).

From August 27 to October 15, 2014, a questionnaire survey had been conducted with physical therapists who were treating or treated stroke patients in Seoul and Gyeonggi-do, South Korea. To look into their perception and use of balance measures for stroke patients and investigate the factors affecting their use, cross-sectional study based on self-administered questionnaire that had a total of 41 questions was performed.

Regarding distribution and collection of questionnaires, we gave the purpose of this study to each institution on the phone; gained their consent; distributed and collected questionnaire by mail, or visited hospitals for distribution and collected questionnaire by mail or revisited them again for collection.

A total of 516 questionnaires were distributed, and 481 were collected. Out of the collected questionnaires, 99 questionnaires that had no check on study participation agreement box, included double answers to one question, or had no answer were excluded. As a result, 382 questionnaires were used for analysis.

The self-administered questionnaire have a total of 41 questions, which are comprised of 7 questions about general characteristics of study subjects, including gender, age, education, clinical career, and the number of daily patient treatments, a type of institution, and location of institution; 8 questions about their perception of balance factors in balance measurement for stroke patients; 11 questions about the use of personal balance measures, including Romberg Test, Functional Reach Test¹⁶), Single Leg Stance Test, TUG test¹⁷), BBS¹⁸), ABC Scale¹⁹), PASS²⁰), MAS²¹), TIS²²), BBA²³), and Instrumented Measurement Tools; 11 questions about their perception of personal balance measures; 4 questions about their comprehensive perception of measurement. The answers of the questionnaire are based on 5-point Likert scale.

To examine internal consistency of the questions, the reliability coefficient Cronbach α was calculated. Perception of balance factors is 0.888, Use of personal measures is 0.772, Perception of personal measures is 0.853 and Comprehensive perception of measurement is 0.771.

This study used SPSS version 21.0 (IBM Co., Armonk, NY, USA) as an analysis program. Frequency analysis was conducted to normalize general characteristics of study subjects, their perception of balance factors, their perception of personal measures in balance measurement for stroke patients, their comprehensive perception of measurement, and their use of personal measures in balance assessment for stroke patients. Stepwise multiple regression analysis was applied to investigate the factors affecting the use of personal measures. Statistical significance level of all data was set to 0.05.

Table 1. General characteristics of study subjects (N=382)

Background factors	Type	Respondents (n)	Percentage (%)
Gender	Male	239	62.6
	Female	143	37.4
Age	≤30 years	247	64.7
	31–40 years	118	30.9
	≥41 years	17	4.5
Education	Diploma	104	27.2
	Bachelor's	202	52.9
	Over graduate school	76	19.9
Career of stroke patient treatment	≤5 years	268	70.2
	6–10 years	77	20.2
	>10 years	37	9.7
Number of daily treatment cases	<10 cases	48	12.6
	10–14 cases	278	72.8
	≥15 cases	56	14.7
Institution type	Tertiary hospital	64	16.8
	General hospital	62	16.2
	Hospital	246	64.4
Institution location	Others	10	2.6
	Seoul	247	64.7
	Gyeonggido	135	35.3
	Total	382	100

Table 2. Perception of balance factors (N=382)

Balance factors	High perception	Middle perception	Low perception	Total
Postural alignment	297 (77.7)	67 (17.5)	18 (4.7)	382 (100)
Static stability	318 (83.2)	59 (15.4)	5 (1.3)	382 (100)
Dynamic stability	317 (83.0)	60 (15.7)	5 (1.3)	382 (100)
Reactive control	211 (55.3)	130 (34.0)	41 (10.7)	382 (100)
Balance within functional tasks	263 (68.8)	96 (25.1)	23 (6.0)	382 (100)
Motor systems	284 (74.4)	84 (22.0)	14 (3.7)	382 (100)
Sensory systems	244 (63.9)	111 (29.1)	27 (7.1)	382 (100)
Cognitive contributions	214 (56.1)	124 (32.5)	44 (11.5)	382 (100)
Total	267 (69.9)	92 (24.1)	23 (6.0)	382 (100)

n (%)

RESULTS

General characteristics of respondents are presented in Table 1. With regard to the questions about their perception of balance factors, 318 persons (83.2%, the highest percentage) replied that static stability was useful, whereas 211 persons (55.3%, the lowest percentage) replied that reactive control was useful (Table 2). Regarding the questions about their perception of personal measures, 287 persons (75.1%) replied that single leg stance test was useful; 268 (70.1%) replied that BBS was useful; 265 (68.4%) replied that functional reach test was useful. BBA was perceived to be the lowest, since 96 (25.2%) replied that it was useful (Table 3). In terms of their comprehensive perception of measurement, 306 (80.2%) perceived that quantifying measurements with the use of measurers was important for patient treatment; 219 (57.4%) perceived that conventional standardized measures were suitable to patient treatment; only 115 (30.1%) perceived that conventional measures were able to be used to measure all balance points (Table 4). According to the data analysis on their use of balance measures, out of 11 standardized personal measures-Romberg Test, Functional Reach Test, Single Leg Stance Test, TUG test, BBS, ABC Scale, PASS, MAS, TIS, BBA, and Instrumented Measurement Tools, Single Leg Stance Test was used by 254 persons (66.5%, the highest percentage), Functional Reach Test by 199 (52.1%), and BBS by 191 (50%). And, BBA was used by 12 (3.1%) only (Table 5). Stepwise multiple regression analysis was conducted to investigate the relative element affecting their

Table 3. Perception of personal measures in balance measurement of stroke patients (N=382)

Measures	High perception	Middle perception	Low perception	Total
Romberg Test	220 (57.6)	145 (38.0)	17 (4.5)	382 (100)
Functional Reach Test	265 (68.4)	99 (25.9)	18 (4.7)	382 (100)
Single Leg Stance Test	287 (75.1)	86 (22.5)	9 (2.4)	382 (100)
TUG	255 (66.8)	108 (28.3)	19 (5.0)	382 (100)
BBS	268 (70.1)	105 (27.5)	9 (2.4)	382 (100)
ABC Scale	113 (29.6)	205 (53.7)	64 (16.8)	382 (100)
PASS	108 (28.2)	212 (55.5)	62 (16.2)	382 (100)
MAS	183 (47.9)	155 (40.6)	44 (11.5)	382 (100)
TIS	150 (39.2)	172 (45.0)	60 (15.7)	382 (100)
BBA	96 (25.2)	210 (55.0)	76 (19.9)	382 (100)
Instrumented Measurement Tools	191 (50.0)	147 (38.5)	44 (11.5)	382 (100)
Total	194 (50.8)	150 (39.3)	38 (9.9)	382 (100)

TUG: timed up&go test; BBS: Berg balance scale; ABC Scale: activities-specific balance confidence scale; PASS: postural assessment scale for stroke patients; MAS: motor assessment scale; TIS: trunk impairment scale; BBA: Brunel balance assessment; n (%)

Table 4. Comprehensive perception of measurement (N=382)

Comprehensive perception of measurement	High perception	Middle perception	Low perception	Total
Is it important to quantify (score) impairments and outcomes with the use of measures in order to treat patients?	306 (80.2)	67 (17.5)	9 (2.4)	382 (100)
Are conventional standardized measures suitable to your patient treatment behavior?	219 (57.4)	154 (40.3)	9 (2.4)	382 (100)
Is it possible to quantify (score) patients' impairments sufficiently with the use of conventional standardized measures?	168 (44.0)	173 (45.3)	41 (10.7)	382 (100)
Do you suppose that conventional standardized measures are able to be used to measure all aspects of balance?	115 (30.1)	167 (43.7)	100 (26.2)	382 (100)
Total	202 (52.9)	140 (36.6)	40 (10.5)	382 (100)

n (%)

Table 5. Use of personal measures in balance measurement of stroke patients (N=382)

Measures	High	Middle	Low	Total
Romberg Test	132 (34.5)	109 (28.5)	141 (36.9)	382 (100)
Functional Reach Test	199 (52.1)	100 (26.2)	83 (21.7)	382 (100)
Single Leg Stance Test	254 (66.5)	87 (22.8)	41 (10.7)	382 (100)
TUG	177 (46.3)	104 (27.2)	101 (26.4)	382 (100)
BBS	191 (50.0)	110 (28.8)	81 (21.2)	382 (100)
ABC Scale	22 (5.7)	62 (16.2)	298 (78.0)	382 (100)
PASS	23 (6.0)	65 (17.0)	294 (77.0)	382 (100)
MAS	157 (41.1)	63 (16.5)	162 (42.3)	382 (100)
TIS	40 (10.5)	76 (19.9)	266 (69.6)	382 (100)
BBA	12 (3.1)	47 (12.3)	323 (84.6)	382 (100)
Instrumented Measurement Tools	75 (19.6)	73 (19.1)	234 (61.3)	382 (100)
Total	116 (30.3)	82 (21.5)	184 (48.2)	382 (100)

TUG: timed up&go test; BBS: Berg balance scale; ABC Scale: activities-specific balance confidence scale; PASS: postural assessment scale for stroke patients; MAS: motor assessment scale; TIS: trunk impairment scale; BBA: Brunel balance assessment; n (%)

Table 6. The relative element affecting use of personal measures

Criterion variable	Predictor variables	β	t	ΔR^2	F
Use of personal measures	Perception of personal measures	0.166	3.315**	0.049	19.605***
	Comprehensive perception of measurement	0.134	2.908*	0.023	14.623***
	Perception of balance factors	0.099	2.070*	0.010	11.262***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

use of personal measures in balance measurement for stroke patients. As a result, the most influential factor was physical therapists' perception of personal measures ($\beta=0.166$), and their use was also influenced by their comprehensive perception of measurement ($\beta=0.134$) and their perception of balance factors ($\beta=0.099$) (Table 6).

DISCUSSION

Objective balance assessment for stroke patients is not only aimed at predicting the risk of fall, finding the causes of balance problems, and accomplishing efficient treatment and care, but also critical to evidence-based practice to improve balance ability^{6, 8}). Therefore, in order to survey physical therapists' perception and use of balance measures for stroke patients and investigate the relative element affecting their use, this study was conducted. Based on the results, it tried to provide a fundamental material to apply effective measures.

With respect to their perception of balance factors, they highly perceived such sub categories of balance measures as static stability and dynamic stability. However, reactive control was perceived to be low, since it was made by the non-standardized approaches and observational assessment. The result was consistent with the result of the research by Sibley et al^{24, 25}).

In terms of balance measures, although BBA has high reliability, high validity, and high clinical suitability, BBA is perceived to be remarkably lower than other measures domestically. That seems to be because Berg Balance Scale, ABC scale, PASS, MAS, and TIS are translated in Korean and introduced in the nation but BBA is not known domestically^{26, 27}).

According to the analysis on their comprehensive perception of measurement, they perceived that for patient treatment it was important to use balance measures for stroke patients to quantify the measurement results, but negatively perceived that there were too many balance measures and it was impossible to measure all balance and damage points of stroke patients with the use of such balance measures. It was considered that such negative perception was made because one measure had a limited range of measurement. Therefore, to improve the problem and make an efficient measurement, it is necessary to use a measure with a wide range of measurement, or to apply multiple balance measures rather than a single one^{14, 28}). Aside from that, it is needed to develop a new balance measure suitable to clinical practice.

According to the analysis on their use of personal measures, they preferred Single Leg Stance Test the most, and applied functional performance measures, such as Functional Reach Test and TUG, more than ordinal scale based measures. It indicated that they preferred simple measures in busy clinical setting¹⁵).

According to stepwise multiple regression analysis, the factors affecting their use of personal measures, their perception of personal measures, their comprehensive perception of measurement, and their perception of balance factors gave influence on the use. General characteristics didn't give any influence in the analysis on the use of personal measures and in stepwise multiple regression analysis. The result was not consistent with the result of the research by McGinnis et al., according to which education based knowledge would influence a choice of a measurement tool²⁹). Such a difference had something to do with different national curriculums³⁰).

Regarding the number of daily treatment cases in their general characteristics, 278 persons (70.2%) had 10–14 daily treatment cases, 56 persons (14.7%) lower than 15 cases, and 334 (87.5%) more than 10 cases. Compared to the result of a previous study in Canada according to which 291 physical therapists (78.9%) had 10 daily treatment cases²⁴), the result of this study revealed that Korean physical therapists worked in busy clinical circumstances. Although there was no statistically significant result, it would influence a choice of a measure, and will become an indication to show different clinical conditions between nations. Also, it was considered that different medical insurance systems between nations would influence the use of a measure.

This study revealed physical therapists' perception and use of balance measures for stroke patients and showed that their perception of balance measures for stroke patients affected their use of personal measures. Therefore, the study results will be used as a fundamental material to choose effective measures.

This study has its limitations. First, it was applied to 382 study subjects in Seoul and Gyeonggi-do, South Korea so that it is hard to generalize the study results. Secondly, given numerous other personal measures than the selected 11 ones, this study failed to investigate physical therapists' perception and use of all measures. Thirdly, since the study was based on the self-administered questionnaire, physical therapists' actual performance could be different and their personal subject views and bias could be included.

In the future, it will be necessary to study more the factors that influence physical therapists' decision-making in choosing a measure. In addition, it will be needed to conduct a comparison analysis on the use of balance measures in different nations.

Through this study, it can be concluded that the Single Leg Stance test is used as the most effective test for many physical therapists during the treatment of stroke patients. However, BBA had the lowest perception and lowest measurement use. Also, this study showed that their perception of balance measures for stroke patients affected their use of personal measures. Therefore, the study results will be used as a fundamental material to choose effective measures.

Conflict of interest

The authors declare no conflict of interest.

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