



Original Article

Reliability and validity of the Korean version of the community balance and mobility scale in patients with hemiplegia after stroke

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Abstract. [Purpose] The aim of this study was to translate and adapt the Community Balance and Mobility Scale (CB&M) into Korean (K-CB&M) and to verify the reliability and validity of scores obtained with Korean patients. [Subjects and Methods] A total of 16 subjects were recruited from St. Vincent's Hospital in South Korea. At each testing session, subjects completed the K-CB&M, Berg balance scale (BBS), timed up and go test (TUG), and functional reaching test. All tests were administered by a physical therapist, and subjects completed the tests in an identical standardized order during all testing sessions. [Results] The inter- and intra-rater reliability coefficients were high for most subscores, while moderate inter-rater reliability was observed for the items "walking and looking" and "walk, look, and carry", and moderate intra-rater reliability was observed for "forward to backward walking". There was a positive correlation between the K-CB&M and BBS and a negative correlation between the K-CB&M and TUG in the convergent validity assessments. [Conclusion] The reliability and validity of the K-CB&M was high, suggesting that clinical practitioners treating Korean patients with hemiplegia can use this material for assessing static and dynamic balance.

Key words: Community Balance and Mobility Scale, Balance, Stroke

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INTRODUCTION

Some assessment tools, including the Berg balance scale (BBS), postural assessment scale for stroke (PASS), balance subscale of the Fugl-Meyer test, and timed up and go test (TUG), have been developed and are often used to evaluate balance and mobility in patients with stroke. However, when evaluating subjects with mild neurological impairment, the utility of these scales can be limited by ceiling effects. The Community Balance and Mobility Scale (CB&M) was created and developed to evaluate community-level functional deficits in both mobility and dynamic balance. This scale was made for assessing sophisticated balance and mobility activities such as quick direction changes and dual tasking, originally in young traumatic brain injury (TBI) patients. Significantly, the CB&M has been validated in able-bodied individuals and TBI and stroke patient populations. The scale is easy to apply, requires minimal equipment, and consists of items assessing functional balance and mobility. The CB&M can precisely evaluate the variability in patients and changes in scores, and it does not produce the ceiling effects typically seen with the BBS and TUG in the assessment of balance and mobility¹⁾. The CB&M comprises 13 tasks such as bending, turning, or looking while walking; single-leg standing; and stair descent²⁾. Studies have also found that the CB&M was superior to the BBS and TUG for verifying improvements in mobility and balance, which

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Table 1. Demographics and clinical characteristics of the participants (N=16)

Variables	All participants
Age (yrs)	44.4 ± 15.9
Gender	
Male/female	5/11 (31.3/68.8)
Side of hemiplegia	
Left/right	4/12 (25.0/75.0)
Type of stroke	
Infarction/hemorrhage	4/12 (25.0/75.0)
Brain lesion location	
Cortex/subcortex/mixed	3/5/8 (18.8/31.3/50.0)
Time poststroke (months)	47.6 ± 39.4
MMSE score	26.80 ± 2.8
Functional ambulatory scale (4/5)	4/5 (0.0/100)

Values, N (%) or Mean ± standard deviation; MMSE: Mini mental state evaluation

Table 2. Inter-rater reliability of K-CB&M subscores (N=16)

Item	ICC	95% Confidence interval (CI)
Unilateral stance	0.882*	0.693, 0.952
Tandem walking	0.842*	0.608, 0.942
180° tandem pivot	0.947*	0.856, 0.981
Lateral foot scooting	0.922*	0.768, 0.973
Hopping forward	0.936*	0.831, 0.977
Crouch and walk	0.845*	0.570, 0.945
Lateral dodging	0.854*	0.639, 0.946
Walking & looking	0.517*	0.067, 0.797
Running with controlled stop	0.867*	0.654, 0.952
Forward to backward walking	0.721*	0.381, 0.892
Walk, look, and carry	0.542*	0.088, 0.811
Descending stairs	0.884*	0.708, 0.958
Step-ups × 1 step	0.829*	0.551, 0.706

*p<0.05; ICC: intraclass correlation coefficient; K-CB&M: Korean version of the Community Balance and Mobility Scale

is important for assessing the progression of recovery and efficacy of physical therapy, and it may be more appropriate for ambulatory patients with moderate to mild post-stroke deficits¹). Therefore, the purpose of this study was to examine the intra- and inter-rater reliability and convergent validity of the Korean version of the CB&M (K-CB&M) compared with that of the BBS, TUG, and functional reaching test (FRT) in patients with hemiplegia whose native language is Korean.

SUBJECTS AND METHODS

The K-CB&M was originally developed by Howe et al., and its usefulness has been confirmed by Howe³). The K-CB&M was initially translated by two persons proficient in English whose native language is Korean, after the objective of the study was explained to them. The two translations were compared, and when differences were identified, the texts were modified to obtain a consensus between the two translations regarding the initial translation. Subsequently, the K-CB&M was translated back into English by a physical therapist whose native language is English, who was unaware of the original version and the objective of the study. To test the reliability of the K-CB&M in the current study, the scale (final version) was administered to 16 patients during two assessments. Patients were recruited from St. Vincent's Hospital in South Korea. The inclusion criteria were as follows: 1) a diagnosis of stroke, 2) more than 5 months after stroke onset, 3) more than 24 points on the mini mental state evaluation, 4) adequate ability to follow verbal commands in Korean, 5) first unilateral hemispheric stroke, and 6) able to walk indoors with or without a gait aid. All of the recruited subjects gave their written informed consent before participation, and this study conformed to the principles of the Declaration of Helsinki. Demographics and clinical characteristics of the participants are shown in Table 1.

At each testing session, participants completed the K-CB&M, BBS⁴), TUG⁵), and FRT⁶). All tests were administered by a physical therapist, and participants completed the tests in an identical standardized order during all testing sessions. For this study, the K-CB&M was scored by two trained physical therapists with more than 5 years of experience. Assessment of the K-CB&M takes approximately 15 minutes to complete by trained physical therapists and requires minimal equipment, including 2 weighted bags, an 8 m track with a target on the wall, a stopwatch, a set of 3 stair steps, and a beanbag⁷). Inter- and intra-rater reliability of the K-CB&M subscores was determined using intraclass correlation coefficients, and convergent validity between the K-CB&M and other tests of balance and mobility was calculated using Spearman correlation coefficients.

RESULTS

High reliability was observed for both inter- and intra-rater reliability correlation coefficients, while moderate inter-rater reliability was observed for the items "walking and looking" and "walk, look, and carry", and moderate intra-rater reliability was observed for "forward to backward walking". Inter- and intra-rater correlation coefficients are shown in Tables 2 and 3, respectively. Furthermore, there was a positive correlation between the K-CB&M and BBS and a negative correlation between the K-CB&M and TUG in the assessment of convergent validity. The convergent validity is shown in Table 4.

Table 3. Intra-rater reliability of K-CB&M subscores (N=16)

Item	ICC	95% Confidence interval (CI)
Unilateral stance	0.892*	0.722, 0.961
Tandem walking	0.957*	0.884, 0.985
180° tandem pivot	0.850*	0.621, 0.945
Lateral foot scooting	0.942*	0.836, 0.980
Hopping forward	0.978*	0.941, 0.992
Crouch and walk	0.738*	0.393, 0.900
Lateral dodging	0.930*	0.801, 0.975
Walking & looking	0.926*	0.807, 0.973
Running with controlled stop	0.951*	0.868, 0.983
Forward to backward walking	0.640*	0.245, 0.856
Walk, look, and carry	0.957*	0.883, 0.985
Descending stairs	0.954*	0.874, 0.983
Step-ups × 1 step	0.803*	0.518, 0.927

*p<0.05; ICC: intraclass correlation coefficient; K-CB&M: Korean version of the Community Balance and Mobility Scale

Table 4. Convergent validity of K-CB&M with BBS, TUG, and FRT (N=16)

Variables	K-CB&M	BBS	TUG	FRT
CB&M	1.000			
BBS	0.781**	1.000		
TUG	-0.625*	-0.637*	1.000	
FRT	0.163	0.505	-0.410	1.000

Values are Spearman correlation coefficients. **p<0.01; *p<0.05; K-CB&M: Korean version of the Community Balance and Mobility Scale; BBS: Berg balance scale; TUG: Timed up and go test; FRT: Functional reaching test

DISCUSSION

The CB&M was created and developed to be used in clinical settings to assess the complex gait skills that are important for the more difficult tasks required for functioning in the community². Many studies have shown that muscle power in the lower limbs is an important element of balance and ambulatory function in able-bodied individuals as well as adults after stroke⁸. The CB&M consists of challenging tasks commonly performed in the community (e.g., walking and looking at a target), to evaluate a wide range of abilities related to mobility and balance of ambulatory patients. This scale was found to have high reliability (intraclass correlation coefficients of 0.98 for intratest, intertest, and test-retest reliability), high internal consistency (Cronbach's α of 0.96), and moderate content and construct validity ($r=0.62$ and 0.64 , respectively)¹. In the present study, inter- and intra-rater reliability coefficients were high, ranging from 0.517 to 0.947 and 0.64 to 0.978, respectively. Thus, the K-CB&M can be used in clinical sessions to assess static and dynamic balance in Korean patients with hemiplegia after stroke. Mao et al. researched the psychometric properties of the balance subscale of the Fugl-Meyer test, BBS, and PASS among subjects after strokes of varying severity. According to these authors, all 3 balance assessments demonstrated excellent inter-rater reliability (intraclass correlation coefficients ranged from 0.92–0.97) and high intra-rater consistency (Cronbach's α ranged from 0.85–0.98)⁹. In this study, a strong relationship was observed between the K-CB&M and BBS assessments. This demonstrates that the K-CB&M is effective for assessing static balance. In addition, there were important correlations of moderate to outstanding magnitude between CB&M scores and all gait conditions. This finding suggests that the CB&M is an important construct to assess specific dynamic balance². The same result was observed for the convergent validity between the K-CB&M and TUG in the present study. Therefore, the K-CB&M is an effective assessment tool for dynamic balance in patients with hemiplegia. In this study, the effectiveness of the K-CB&M was demonstrated, so that, clinical practitioners treating patients using the Korean language can use this material for assessing static and dynamic balance, like the BBS and TUG.

REFERENCES

- 1) Knorr S, Brouwer B, Garland SJ: Validity of the Community Balance and Mobility Scale in community-dwelling persons after stroke. *Arch Phys Med Rehabil*, 2010, 91: 890–896. [Medline] [CrossRef]
- 2) Inness EL, Howe JA, Niechwiej-Szwedo E, et al.: Measuring balance and mobility after traumatic brain injury: validation of the Community Balance and Mobility Scale (CB&M). *Physiother Can*, 2011, 63: 199–208. [Medline] [CrossRef]
- 3) Howe JA, Inness EL, Venturini A, et al.: The Community Balance and Mobility Scale—a balance measure for individuals with traumatic brain injury. *Clin Rehabil*, 2006, 20: 885–895. [Medline]
- 4) Berg KO, Wood-Dauphinee SL, Williams JL, et al.: Measuring balance in the elderly: validation of an instrument. *Can J Public Health*, 1992, 83: S7–S11. [Medline]
- 5) Steffen TM, Hacker TA, Mollinger L: Age- and gender-related test performance in community-dwelling elderly people: Six-Minute Walk Test, Berg Balance

Scale, Timed Up & Go Test, and gait speeds. *Phys Ther*, 2002, 82: 128–137. [[Medline](#)]

- 6) Duncan PW, Weiner DK, Chandler J, et al.: Functional reach: a new clinical measure of balance. *J Gerontol*, 1990, 45: M192–M197. [[Medline](#)] [[CrossRef](#)]
- 7) Takacs J, Garland SJ, Carpenter MG, et al.: Validity and reliability of the community balance and mobility scale in individuals with knee osteoarthritis. *Phys Ther*, 2014, 94: 866–874. [[Medline](#)] [[CrossRef](#)]
- 8) Eng JJ, Chu KS, Dawson AS, et al.: Functional walk tests in individuals with stroke: relation to perceived exertion and myocardial exertion. *Stroke*, 2002, 33: 756–761. [[Medline](#)] [[CrossRef](#)]
- 9) Mao HF, Hsueh IP, Tang PF, et al.: Analysis and comparison of the psychometric properties of three balance measures for stroke patients. *Stroke*, 2002, 33: 1022–1027. [[Medline](#)] [[CrossRef](#)]