Comparing the Mini-BES Test to Berg Balance Scale in People with Multiple Sclerosis

Meshaal Dayel, PT[1], Maryam Aloumi, PT[2], Hessah Mohammad, PT[3], Suad Abdul Rahman, PT[4], & Sharifah Alragum, PhD[5]

Abstract

Background: The prevalence of multiple sclerosis (MS) is increasing among young adults in Kuwait. There is a need for a valid system-specific outcome measure that identifies balance deficiencies and treats them accordingly. The aim of the study was to examine the validity of the Mini-BES Test and its accuracy in classifying people with MS based on fall history. **Methods:** Twenty-six patients with MS participated in the study. Participants performed the Berg Balance Scale (BBS) and the Mini-BES Test. Validity was assessed by correlating scores of the Mini-BES Test with scores of the BBS, and by comparing scores between fallers and non-fallers. **Results:** There was a significant correlation between the two outcome measures (r=0.87) and a significant correlation between the Mini-BES Test and history of falling (r=-0.57). The scores on the Mini-BES Test were significantly different between fallers and non-fallers (p<.005). **Conclusion:** The Mini-BES Test is a valid outcome measure for balance deficits in patients with MS. It is able to differentiate between fallers and non-fallers, which helps in designing fall prevention programs.

Keywords: Multiple Sclerosis, Mini-BES Test, Balance, Validity

1. Introduction

Multiple sclerosis (MS) is a common progressive neurologic disease in young adults. The epidemiology of MS is changing in many parts of the world. In recent years, Kuwait is considered a high-risk geographical area for MS (1).Postural instability and balance deficits are common devastating impairments associated with MS. These impairments increase the risk of falling; preventing patients from performing their daily activities in a safe way (9).One study reported a mean of 9 falls per year for a mixed population of MS inpatients and outpatients (3). Therefore, the assessment of balance and postural control with an accurate determination of factors contributing to falls is necessary for the development of fall prevention programs for patients with MS. Over the past decade, balance-related instruments such as the Berg Balance Scale (BBS), Dynamic Gait Index (DGI) and Timed Up and Go test (TUG) have become increasingly popular in clinical studies of patients with MS (4).

The BBS is a 14-item test that focuses on a number of self-initiated tasks that are needed in everyday function such as sit-to-stand and reaching forward. The TUG is a measure of dynamic balance that requires an individual to stand up, walk for 3m, turn, and walk back to the chair. The DGI is an 8-item scale that measures dynamic balance and functional mobility while walking and going up the stairs.

[1]Department of Physical Therapy, Ibn Sina, Hospital, Kuwait. Meshaal669@hotmail.com
[2]Department of Physical Therapy, Maternity Hospital, Kuwait. Maryam_aloumi@hotmail.com
[3]Department of Physical Therapy, Chest Diseases Hospital, Kuwait. Pt.hessah@gmail.com
[4]Department of Physical Therapy, Farwaniya Hospital, Kuwait. Suad_95@hotmail.com
[5]Department of Physical Therapy, Faculty of Allied Health Sciences, Kuwait University, Kuwait. salragum@hsc.edu.kw, Phone: 965-2463-3420, Fax965-2463-4865.

When the three balance scales were used in a sample of patients with MS, they had good concurrent validity. Participants showed moderate impairment in static balance and more pronounced impairment in dynamic balance. Ceiling effects occurred 4 times in the DGI and 3times in the BBS. Furthermore, the BBS and DGI were not efficient in discriminating between fallers and non-fallers (4). Other researchers suggested that the BBS should be used in conjunction with other balance assessment tools because items that require postural responses to external stimuli and uneven surfaces are not included in the test (2).Such documented limitations of the BBS and DGI have led many clinicians to use more than one validated balance assessment in order to detect deficits that may respond to treatment.

Recently, a more comprehensive clinical balance test, the Balance Evaluation Systems Test (BES Test), has been developed. It is essentially a battery of balance and mobility tests based on items from other validated tests combined with new items. The BES Test was uniquely designed to evaluate six different balance control systems: biomechanical, stability limits/verticality, anticipatory, reactive, sensory orientation, and stability in gait. This system-specific assessment is helpful in directing treatment and making sure that a deficit is not neglected (6). The BES Test has good validity and is able to discriminate between fallers and non-fallers in patients with MS (7).

The BES Test, though comprehensive, valid, and reliable, takes too long to complete, which may not always be practical in a busy clinical setting. Thus, by using psychometric techniques to reduce item redundancy and simplify scoring, a shorter version of the BES Test, which is the Mini-BES Test, was developed. The Mini-BES Test contains 14 items of the original 36 items. It evaluates four balance control systems: anticipatory, reactive, sensory orientation, and stability in gait. The items on the Mini-BES Test are scored on a 3-point scale ranging from (0) to (2). A score of (0) indicates the lowest level of function and a score of (2) indicates the highest level of function, leading to a possible total score of 28 points (12).

This shorter version has excellent inter-rater reliability, test-retest reliability, and good correlation with other balance outcome measures in patients with stroke (11) as well as a high accuracy in detecting patient's improvement in balance function (5). However, how the Mini-BES Test compared to the BBS in detecting balance deficits in patients with MS is currently unknown.

1.1 Validation:

Criterion validity examines the correlation of a new scale with a known scale of the same features or disorders under study, preferably, a 'gold standard' that has been validated and used before. One type of criterion validity is concurrent validity, in which the new scale and the known scale are taken at the same time. It is useful when the new scale is more efficient, easier to administer, and is being proposed as an alternative instrument (10,8).

1.2 Purpose:

The aims of our study were: 1. to examine the concurrent validity of the Mini-BES Test by looking at its correlation with the BBS, which is considered the gold standard in the field, in a sample of patients with MS, 2. to examine the discriminative validity of the Mini-BES Test by looking at its ability to discriminate between fallers and non-fallers in the same sample.

2. Methods

2.1 Participants:

Patients with MS, with or without history of falling, between the ages of twenty to fifty years and referred to the physical therapy department in Ibn Sina hospital or being members in the Kuwaiti Multiple Sclerosis Association were recruited for this study. Patients with other neurological or musculoskeletal disorders that limit their ability to perform tasks in the balance outcome measures were excluded. Participants gave written and informed consent approved by the Health Sciences Center's Ethics Committee for Student Research.

2.3 Procedure:

Individuals who met the inclusion criteria were enrolled to participate in the study. After describing the procedure, the research team obtained the individual's consent to participate. Demographic data, clinical conditions, and history of falling were collected. Then, balance was tested using the BBS and the Mini-BES Test. A rest period of 15 minutes was given between both tests.

2.4 Data analysis:

Data management and analysis were carried out using the computer software 'Statistical Package for Social Sciences, SPSS version 22.0'. The descriptive statistics run generated frequencies and percentages for all categorical variables. The quantitative or continuous variables were presented as mean ± standard deviation. Mean differences were compared with t-test. The correlation analysis was used to establish any correlation between the variables. The two-tailed probability value 'p' <0.05 was considered statistically significant.

3. Results

3.1 Participants' characteristics

A total of 27 patients with MS (8 females, 19 males) with mean age of 35 years (±7.78) and mean duration of MS as 7 years (±5.90) were recruited for the study. One female participant was excluded from the study because she was not able to complete the Mini-BES Test, making a total of 26 participants. Table 1 shows participants' characteristics in terms of frequency and percentage. The majority of the participants were male, married, and with high school and above education. The majority of the participants did not have a fall in the three months prior to data collection.

3.2 The relation between the Mini-BES Test and the BBS

Spearman's correlation was used to determine the relationship between the Mini-BES Test and the BBS. As shown in Table 2, there was a significant high positive correlation between the scores of the Mini-BES Test and the scores of the BBS ($r = 0.868$, $p < 0.01$). Spearman's correlation was also used to determine the relationship between each outcome measure and the history of falling and duration of MS. As shown in Table 2, there was a significant high negative correlation between the Mini-BES Test and the history of falling ($r = -0.568$, $p < 0.01$) and a significant medium negative correlation between the BBS and history of falling ($r = -0.490$, $p<0.05$).Moreover, there was a moderate negative correlation between the Mini-BES Test and the duration of MS ($r = -0.353$) and the BBS and the duration of MS ($r = -0.367$). However, the correlation was not significant.

Table 1: Participants' Characteristics

Participants' characteristics	Frequency	%
Gender		
Male	19	73.07%
Female	7	26.92%
Education		
Less than High school	2	7.69%
High school	10	38.46%
Undergraduate	6	23.07%
Postgraduate	8	30.76%
Marital status		
Married	16	61.53%
Unmarried	10	38.46%
Smoking		
Smoker	12	46.15%
Non-smoker	14	53.84%
Fall history (In the last 3 months)		
None	18	69.23%
Once	2	7.69%
Twice	3	11.53%
Three times	2	7.41%
More than three	1	7.41%

Table 2: The correlation between the BBS and Mini-BES Test with history of falling and duration of MS

	Mini-BESTest	BBS	History of falling	Duration of MS
Mini-BESTest		0.868**	-0.568**	-0.353
BBS	0.868**		-0.491*	-0.367
History of falling	-0.568**	-0.491*		0.145
Duration of MS	-0.353	-0.367	0.145	

*Correlation is significant at the 0.05 level (2-tailed)
**Correlation is significant at the 0.01 level (2-tailed)

3.3 The difference between fallers and non-fallers

There were 8 participants who had a history of falling in the three months prior to data collection. Independent Samples Test was used to determine if the scores on the two outcome measures are different between fallers and non-fallers. As shown in Table 3, there was a significant difference between fallers and non-fallers in the scores of the Mini-BES Test (p = 0.005) and the scores of the BBS (p = 0.05).

Table 3: The mean and standard deviation of the scores between fallers and non-fallers

	Fallers		Non-fallers	
	Mean	SD	Mean	SD
BBS Total score 65	42.25*	10.91	50.5*	8.07
Mini-BESTestTotal score 28	14.75**	5.56	21.6**	4.71

*Independent T-Test p=0.05. **Independent T-Test p=0.005.

4. Discussion

Patients with MS have severe problems in gait and balance. Since the prevalence of MS is increasing among young adults in Kuwait, there is a need to understand balance performance of patients with MS. In order to do so, we need a valid system-specific outcome measure, like the Mini-BES Test, to help us identify balance deficits and treat them accordingly. In this study, we examined the concurrent validity of the Mini-BES Test by looking at its correlation with the BBS. Our results showed a significant high correlation between the Mini-BES Test and the BBS, which supports the concurrent validity of the Mini-BES Test.

We also examined the correlation between the Mini-BES Test and the history of falling and the ability of the Mini-BES Test to discriminate between fallers and non-fallers. The study showed a significant high correlation between the Mini-BES Test and the history of falling. Furthermore, the Mini-BES Test was able to differentiate between fallers and non-fallers. This can help physical therapists to identify patients who are fallers or at risk of falling and treat them as needed. There was low to moderate correlation between the Mini-BES Test with multiple variables; further studies with larger sample size are needed to confirm these findings.

5. Conclusion

The study results confirm that the Mini-BES Test is a feasible and a valid outcome measure. We believe that the Mini-BES Test is more efficient and can replace the BBS in evaluating patients with MS in the clinics. The study has several limitations. The small sample size, which was affected by the short time available for data collection. The recruitment was mainly from one hospital, other hospitals should be considered as well.

Reference List

Alroughani, R., Ahmed, S. F., Behbahani, R., Khan, R., Thussu, A., Alexander, K. J., Al-Hashel, J. (2014). Increasing prevalence and incidence rates of multiple sclerosis in Kuwait. Mult Scler, 20(5), 543-547.

Blum, L., and Korner-Bitensky, N. (2008). Usefulness of the Berg Balance Scale in stroke rehabilitation: a systematic review. Phys Ther, 88(5), 559-566.

Cattaneo, D., De Nuzzo, C., Fascia, T., Macalli, M., Pisoni, I., & Cardini, R. (2002). Risks of falls in subjects with multiple sclerosis. Archives of Physical Medicine and Rehabilitation, 83(6), 864-867.

Cattaneo, D., Regola, A., & Meotti, M. (2006). Validity of six balance disorders scales in persons with multiple sclerosis. Disabil Rehabil, 28(12), 789-795.

Godi, M., Franchignoni, F., Caligari, M., Giordano, A., Turcato, A. M., & Nardone, A. (2013). Comparison of reliability, validity, and responsiveness of the mini-BES Test and Berg Balance Scale in patients with balance disorders. PhysTher, 93(2), 158-167.

Horak, F. B., Wrisley, D. M., & Frank, J. (2009). The Balance Evaluation Systems Test (BES Test) to differentiate balance deficits. Phys Ther, 89(5), 484-498.

Jacobs, J. V., & Kasser, S. L. (2012). Balance impairment in people with multiple sclerosis: preliminary evidence for the Balance Evaluation Systems Test. Gait Posture, 36(3), 414-418.

McDowell, I. (2006). Measuring health: A guide to rating scales and St louis, Mo Elsevier/Mosby,2013questionnaires (3rd ed.). New York: Oxford University Press.

O'Sullivan S, Scemitz T, Fulk G. (2014). Physical Rehabilitation 6th edition; Philadelphia : F.A. Davis Co.

Portney, L. G., & Watkins, M. P. (2000). Foundations of clinical research: Applications to practice (2nd ed.). New Jersey: Prentice Hall Health.

Tsang, C. S., Liao, L. R., Chung, R. C., & Pang, M. Y. (2013). Psychometric properties of the Mini-Balance Evaluation Systems Test (Mini-BES Test) in community-dwelling individuals with chronic stroke. Phys Ther, 93(8), 1102-1115.

Yingyongyudha, A., Saengsirisuwan, V., Panichaporn, W., & Boonsinsukh, R. (2015). The Mini-Balance Evaluation Systems Test (Mini-BESTest) Demonstrates Higher Accuracy in Identifying Older Adult Participants With History of Falls Than Do the BES Test, Berg Balance Scale, or Timed Up and Go Test. J Geriatr Phys Ther, 39 (2), 64-70.