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A study to find out the inter – rater and intra – rater reliability of Brunel balance assessment scale in assessment of functional balance of post stroke patients: An observational study

Dafda Renuka H
Assistant Professor, Department of Physiotherapy, Shri K.K Sheth Physiotherapy College, Prakash Society Main Road, Opp. Nirmala convent school Rajkot, Gujarat, India

Abstract
Background: Stroke or brain attack is a sudden loss of neurological function caused by an interruption of the blood flow to the brain. The Brunel Balance Assessment (BBA) scale is designed to assess functional balance in post stroke patients.
Objective: to find out the inter- rater and intra- rater reliability of Brunel Balance Assessment scale in post-stroke patients.
Method: The patients were assessed using BBA scale by two rater for inter rater reliability and by same rater at different time for test retest reliability.
Outcome Measures: Brunel Balance Assessment scale.
Results: Intra rater and inter rater reliability of Brunel Balance Assessment scale were assessed by ICC. ICC for intra rater reliability i. 907 with $p < 0.01$ and for inter rater reliability ICC =. 923 with $p < 0.01$.
Conclusion: BBA scale is reliable to use in stroke subjects.

Keywords: scale, reliability, stroke

Introduction

The term Stroke or brain attack is defined as the sudden loss of neurological function caused by an interruption of the blood flow to the brain [1]. This cuts off the supply of oxygen and nutrients to the brain tissue.

Balance control is a fundamental motor behavior in stance and gait that allows an individual to maintain and adopt various postures, react to external pertubances, and use automatic postural responses that precede voluntary movements [2].

Balance is defined as "Condition in which all the forces acting on the body are balance such that the centre of mass (COM) is within the stability limits, the boundaries of base of support (BOS) [3].

Balance problems are thought to be common after stroke, and they have been implicated in the poor recovery of activities of daily living (ADL) and mobility and an increased risk of falls [4].

The Brunel Balance Assessment (BBA) is designed to assess functional balance for people with a wide range of abilities. It is developed by Dr Sarah Tyson at university of Salford and it is first time published in 2004 [5]. There are three sections to the assessment: sitting, standing and stepping.

There are already many ways of measuring balance, but very less are suitable for use in the clinical setting to assess the effects of individual rehabilitation interventions or to measure change over a short term. Ordinal scales such as the Berg Balance Scale, Motor Assessment Scales or Functional performance tests such as timed walk tests are only suitable for people with a narrow range of abilities [6]. Instrumented measures such as weight distribution or postural sway monitors are expensive, only suitable for a narrow range of abilities [7].

The Brunel Balance Assessment scale has been designed to full fill the criteria that make it suitable for using in clinical setting [5]. It is cost effective, quick, easy to access and simple to administer for balance evaluation in post stroke patients [5]. It is reflective of clinical practice and hence, this is an effort taken to find out the inter- rater and intra- rater reliability of Brunel Balance Assessment Scale in post-stroke patients.

Xiao Lingjun *et al*., (2009) [8, 14] examined validity of Chinese version of Brunel Balance Assessment scale in 43 Chinese stroke patients with hemiplegia and concluded that BBA has good validity. (Correlation coefficients were 0.539 – 0.939) [8].

Clarissa Barros *et al*., (2008) did study on balance control after stroke and he found that balance problems in patients after stroke can be caused by different impairments in the physiological systems involved in postural control, including sensory afferents, movement strategies, biomechanical constraints, cognitive processing and perception of verticality.32 Balance impairments and disabilities must be appropriately addressed. Sensory Modalities and Integration includes three sensory modalities are mainly involved in postural control: somatosensory, visual, and vestibular afferents. Integration of information from these systems is crucial for adequate postural control. In patients with stroke, balance impairments and decreased ankle proprioception are positively correlated [3, 9, 10]. Abnormal interactions between the three sensory systems involved in balance could be the source of abnormal postural reactions. In situations of sensory conflict, a patient with stroke can inappropriately depend on one particular system over another [11]. Relying on a single system can lead to inappropriate adaptations and hence, balance disturbances.

Materials and method

i) Subjects

This study was approved by the Institutional review board and ethical Committee. The written consent has been taken from patients.

ii) Inclusion Criteria

1. Age between 35 years to 65 years.
2. Gender : both male and female
3. Ischemic and hemorrhagic types of stroke.
4. Stroke patients of any stage acute, sub-acute and chronic stages of stroke.

iii) Exclusion Criteria

1. Subjects having language, visual, or cognitive impairments.
2. Any type of recent lower limb fracture.
3. Any type of recent non-paretic upper limb fracture.
4. Uncooperative patient.
5. Subjects having associated other neurological disorder.

iv) Materials to be used

1. Plinth
2. Measuring tape
3. Chair
4. Step up block (7.5 – 10 cm height)
5. Stop watch
6. Data collection sheet
7. Assessment form
8. Pen and paper
9. Consent form

v) Procedure

After the approval of the study from the ethical committee, 30 subjects from Out Patient Department (OPD) centers who fulfilled the inclusion and exclusion criteria were taken for the study purpose. Written informed consent was signed by each subject before proceeding for the study procedure. The demographic data including name, age, sex, affected side, post stroke duration, assistive devices for ambulation were recorded using subject evaluation form. Patients were then explained about the test and procedure to be conducted. The study included one clinical test (Brunel Balance Assessment scale) to examine functional balance in people with stroke.

The Brunel Balance Assessment (BBA) scale was conducted twice by same rater (Rater A1 and Rater A2) at different time (after 24 hours of duration) and also by different rater (Rater B) at same time to find out test-retest and inter- rater reliability. There are three sections for the assessment: sitting, standing and stepping. At each level, the patient receives a score for his/her efforts. This gives an indication on whether the patient is improving within a level, even if he/she is not able to progress to the next level. The score also reflects how well the individual is functioning within that section e.g. sitting, standing or stepping. In BBA scale, there are 12 levels. In sitting, 3 levels are there which includes supported sitting, sitting with arm raise, sitting with forward reach. In standing, 3 levels are there which includes supported standing, standing with arm raise and standing with forward reach. In stepping, 6 levels are there which includes step standing, walking with the help of an aid, weight shifting, walking without an aid, single tap on step and step up on block.

Results & Discussion

Intra rater and inter rater reliability of Brunel Balance Assessment scale were assessed by Intraclass correlation coefficient (ICC). For calculation of data in results, level of significance was set at <0.05. For calculation of intra-rater reliability data of rater A1 and rater A2 were correlated by using ICC. For the calculation of inter-rater reliability data of rater A1 and rater B were correlated by using ICC. Mean and standard deviation were calculated as measure of central tendency and measure of dispersion respectively.

The study was conducted to find out the inter-rater and intra-rater reliability of Brunel Balance Assessment scale in assessment of functional balance of post stroke patients.

In the above study it was found that there is moderately positive correlation between Rater A1 and Rater A2; Rater A1 and Rater B. In this study the result shows that the Brunel Balance Assessment scale (BBA) is a reliable measure in with people with stroke to measure functional balance.

Thus, the results of the present study rejects the null hypothesis and supports the experimental hypothesis i.e. Brunel Balance Assessment scale is having significant inter-rater and intra- rater reliability in measuring functional balance in post- stroke patients.

Biomechanical Constraints includes impairments in range of movement, tone, strength, and muscle control can influence postural control. In hemi paretic patient weakness and impaired muscle control of the affected lower limb, decreased range of motion and pain can lead to changes in the base of support. The intrarater reliability of BBA scale is there so it may not be necessary to perform two trials and it would only take a clinician 5 to 6 minutes to explain, perform, and record the BBA score and also inter rater reliability of BBA scale is also there so there is no significant difference of scores between two rater also. The BBA scale could be used as a quick screening tool to assess the ability to maintain functional balance for people with wide range of abilities in post-stroke.

In this study the result shows that stroke is more prevalent from 61 to 65 years of age, 14 subjects participating in the study included in range of 61 to 65 years. This result is supported by the study done by Sridharan *et al*., in 2009 [12]. He did study on epidemiology of stroke in India and found that incidence rates increase from the 59 years of age [12].

In the result table 5.2 and 5.3 shows the distribution of stroke in both gender and types of stroke respectively. According to these data stroke is more common in male gender than female. Sethi *et al*., in 2002 found that male: female gender ratio for stroke is 7:1 in India.9 Ischemic type of stroke is more prevalent than hemorrhagic type; these findings are supported by the study of Feigin *et al*., in 2009. He found that ischemic type of stroke is 50% to 85% more prevalent [13].

Although the BBA scale was challenging for some participants because this scale includes stepping over block to measure advanced balance, physical therapists that provided physical assistance were able to conduct the test without incident. Nevertheless, the inherent risks observed when conducting a test that involves step standing, weight shifting, step up test in people with stroke reinforces that the BBA

scale should only be administered by staff with adequate training, as recommended by Dr Sarah Tyson [5].

In this scale actual task is to judge to pass or fail a subject on each level of the scale and it is simple, very precise and objective. The tester merely has to decide whether the subject has lifted their arm three times, maintained a position for thirty seconds, performed more than one step-up etc. This does not require any particular clinical skill or detailed ability and so it is not surprising that a high degree of agreement about the subjects' ability to perform such tasks was discovered.

Result of present study is supported by study done by Xiao Lingjun *et al*., in 2010 [14] who found reliability of the Chinese version of Brunel balance assessment scale in Chinese stroke patients with hemiplegia. The BBA scale has good reliability and it is an appropriate tool to assess the balance function of Chinese stroke patients with hemiplegia [14].

Result of present study is supported by study done by Sarah F Tyson in 2004 [5]. He did the research to report the psychometric properties of the Brunel Balance Assessment (BBA), a new test of balance disability post stroke. Data from 92 subjects were collected and cohorts used to test reliability. Thirty-seven people participated in the reliability testing. Test / retest and inter-tester reliability were tested. The testing was repeated on consecutive days to assess test / retest reliability and was scored simultaneously by two physiotherapists for inter-tester reliability. Cronbach's alpha was 0.92. Reliability was high (100% agreement) for both aspects of reliability and concluded that the BBA is a reliable hierarchical measure of balance disability post stroke that is suitable for use in the clinical setting [5].

The present study finding suggests that BBA scale is highly reliable to measure functional balance and it has ability to measure advanced balance in post stroke subjects.

Table 1: Age distribution of subjects (years)

Age Group (YEARS)	No. of Patients
35-40	4(13%)
41-45	2(7%)
46-50	2(7%)
51-55	4(13%)
56-60	4(13%)
61-65	14(47%)
Total	30
Mean (Years)	55.33
SD (Years)	±9.29

Interpretation: The above table shows number of subjects and percentage distribution of subjects' age. The mean age of 30 subjects was 55.33 years with a standard deviation of 9.29 years.

Table 2: Mean Age and SD for stroke subjects (years)

GROUP	N	Minimum (Years)	Maximum (Years)	Mean (Years)	Standard deviation (SD)(years)
Stroke Subjects	30	35	65	55.33	±9.29

Interpretation: The table displays the statistics of age distribution of the 30 stroke subjects. Among the 30 stroke subjects, the mean + SD of age of 30 stroke subjects was 55.33 ± 9.29 years.

Table 3: Gender distribution of subjects

Gender	NO. OF Patient
Male (%)	23 (77%)
Female (%)	7 (23%)
Total	30

Interpretation: The above table shows the number of male and female population participating in the study.

Table 4: Types of stroke

Types	no. of Patient
Ischemic (%)	27 (90%)
Hemorrhagic (%)	3 (10%)
Total	30

Interpretation: The above table shows the number of Ischemic and Hemorrhagic types of stroke in population participating in the study.

Table 5: Intraclass correlation coefficient showing Reliability of Rater A1 of BBA with Rater A2

Z	Measure	Intraclass Correlation Coefficient	p - value	Result
30	Rater A2 (Intra rater reliability)	. 907 (**)	.000	Significant

** Correlation is significant at the 0.01 level (p value <0.01)

Intraclass correlation coefficient (ICC) between Rater A1 and Rater A2 is. 907 with p value <0.01

Above table shows moderately positive correlation between Rater A1 and Rater A2.

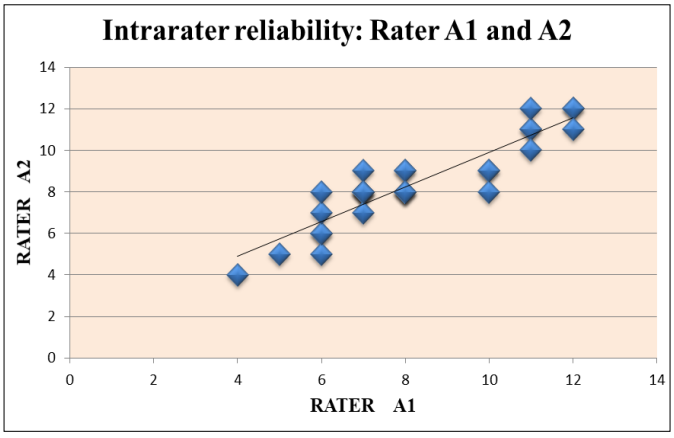

Fig 1: Result of Intraclass correlation coefficient for Intrarater Reliability of Brunel Balance Assessment scale

Table 6: Intraclass correlation coefficient showing Reliability of Rater A1 of BBA with Rater B

No. of patients	Measure	Intraclass Correlation Coefficient	p - value	Result
30	Rater B (Inter rater reliability)	. 923 (**)	.000	Significant

** Correlation is significant at the 0.01 level (p value <0.01)

Intraclass correlation coefficient (ICC) between Rater A1 and Rater B is. 923 with p value <0.01 above table shows moderately positive correlation between Rater A1 and Rater B.

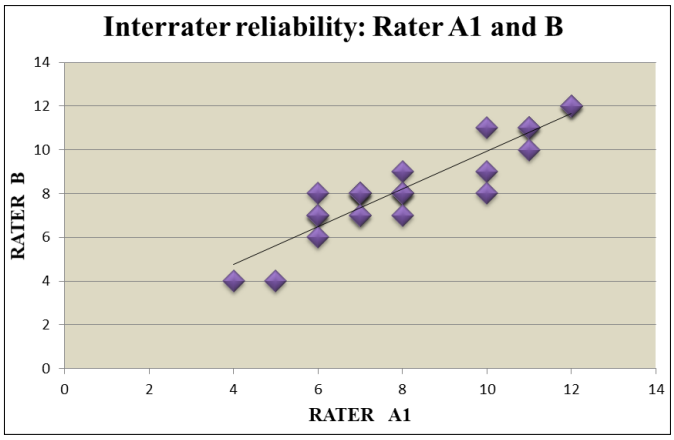

Fig 2: Result of Intraclass correlation coefficient for interrater Reliability of Brunel Balance Assessment scale

Table 7: Mean value and Standard Deviation of BBA scale

Outcome Measure	Rater	Mean	Standard Deviation
Brunel Balance Assessment scale	Rater 1	8.2	±2.25
	Rater 2	8.4	±2.06
	Rater	8.4	±2.09

Conclusion

The BBA scale is an easy-to-administer clinical test with intrarater and inter rater reliability in subjects with stroke to assess functional balance. The results of this study show that the Brunel Balance Assessment scale has a high level of reliability when used by experienced physiotherapists with people who have balance disability caused by a stroke.

Ethical Clearance: Yes

References

1. Susan BO. Sullivan, Thomas J Schmitz; Physical rehabilitation; 5th Edition; Jaypee Brothers, 2006.
2. Alison Orrell J, Frank Eves F, Rich Masters SW. Motor Learning of a Dynamic Balancing Task after Stroke: Implicit Implications for Stroke Rehabilitation. PhysTher. 2006; 86:369-380.
3. Harris JE, Eng JJ, Marigold DS. Relationship of balance and mobility to fall incidence in people with chronic stroke. Phys therapy. 2005; 85:50-158.
4. Sarah F. Tyson, Marie Hanley, Jay Chillala, Andrea Selley and Raymond C Tallis. Balance Disability after Stroke. PhysTher. 2006; 86:30-38.
5. Tyson S, DeSouza L. Development of Brunel Balance Assessment; A new measure of balance disability post-stroke. Clinical Rehabilitation. 2004; 8(7):801-810.
6. Tyson S, DeSouza L. Measurement of balance and walking post stroke: Part 1 ordinal scales. Physical Therapy Reviews. 2002; 3:177-185.
7. Tyson S, Desouza L. Measurement of balance and walking post stroke: Part 3 Instrumented measurement tools. Physical therapy Reviews. 2002; 4:231-241.
8. Xiao Lingjun, LUO, Zirui Lizhen LIAO. Validity and reactivity of the Chinese version of Brunel balance assessment in stroke hemiplegic patients. Chinese Journal of Rehabilitation Medicine, 2009, 02.
9. Keenan MA, Perry J, Jordan C. Factors affecting balance and ambulation following stroke. Clin Orthop Relat Res. 1984; (182):165-171.
10. Niam S, Cheung W, Sullivan PE, Kent S, Gu X. Balance and physical impairments after stroke. Arch Phys Med Rehabil. 1999; 80(10):1227-1233.
11. Nashner LM, Black FO, Wall C 3rd. Adaptation to altered support and visual conditions during stance: Patients with vestibular deficits. J Neurosci. 1982; 2(5):536-544.
12. Sridharan S. Incidence, types, risk factors and outcome of stroke in a developing country: the Trivandrum Stroke Registry. Stroke. 2009; 40:1212-1218.
13. Feigin V, Lawes C, Bennet D, Barker Cello S, Parag V. Worldwide stroke incidence and early case fatality in 56 population based studies: a systematic review. Lancet Neurology. 2009; 8(4):355-369.
14. Xiao Lingjun, Luozirui, LiaoLizhen. Reliability of the Chinese version of Brunel balance assessment in stroke hemiplegic patients. Chinese Journal of Rehabilitation Medicine. 2010, 02.