

Dynamic Balance Performance In Relation To the Dependence in Activities of Daily Living: A Cross-Sectional Study in Stroke Patients

Víctor Sánchez Silverio^{1*}, Vanesa Abuín Porras², Isabel Rodríguez Costa³

¹School of Medicine, Pontificia Universidad Católica Madre y Maestra. Autopista Duarte Km 1 1/2, 51000 Santiago De Los Caballeros, Dominican Republic.

²Physiotherapy department, Universidad Europea de Madrid. Calle Tajo, s/n, 28670 Villaviciosa de Odón, Madrid, Spain.

³Nursing and physiotherapy department, Universidad de Alcalá de Henares. Plaza de San Diego, s/n, 28801 Alcalá de Henares, Madrid, Spain.

***Corresponding author:** Víctor Sánchez Silverio, School of Medicine, Pontificia Universidad Católica Madre y Maestra. Autopista Duarte Km 1 1/2, 51000 Santiago De Los Caballeros, Dominican Republic.

Received date: July 06, 2020; **Accepted date:** July 10, 2020; **published date:** July 15, 2020

Citation: Víctor Sánchez Silverio, Vanesa Abuín Porras, Isabel Rodríguez Costa. Dynamic Balance Performance In Relation To the Dependence in Activities of Daily Living: A Cross-Sectional Study in Stroke Patients. J Clinical Research and Reports, 4(5); DOI:10.31579/2690-1919/103

Copyright: © 2020 Víctor Sánchez Silverio. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Abstract

Aim: to determine if dynamic balance is related to activities of daily living (ADL) dependence in stroke patients.

Methods: a cross-sectional study was carried out. The Barthel index (BI) was used to assess ADL dependence. The Timed Up and Go Test (TUG) and the Four Square Step Test (FSST) were used to evaluate dynamic balance. A Spearman correlation was used assuming a data abnormality in the performance of TUG and FSST and considering a significance of $p < 0.05$.

Results: 62 stroke patients were evaluated. The BI showed correlations with the performance of the TUG and the FSST. These correlations were also found between performance of both balance tests and ADLs, such as bathing, moving, and going up and down stairs. In contrast to TUG, correlations were estimated between the ADL related to dressing and the performance of the FSST.

Conclusion: dynamic balance evaluated by the TUG and the FSST showed correlations with the ADL dependency in stroke patients.

Keywords: Stroke; Dynamic balance; Activity of daily living; Timed Up and Go Test; Four Square Step Test; Barthel index

Introduction

Stroke is one of the main causes of disability in different countries. The ability to perform activities of daily living (ADL) can be significantly affected after a stroke. It has been estimated that 25% to 74% of stroke survivors worldwide require some assistance or are fully dependent on caregivers for ADL [1]. Studies have reported that the activities with the greatest difficulty in recovery after a stroke are related to dressing, stairs climbing and bathing [2]. Furthermore, the evidence has recognized that ADLs have a great functional impact in stroke patients [3].

On the other hand, balance is an important ability affected by stroke. This ability is essential to all functional activities during sitting and standing [4]. The authors indicate that balance disability affects more than 80% of patients post-stroke with falls occurring in 40%–70% of stroke survivors [5]. Evidence suggests that impaired balance after stroke results in decreased functional independence and increased risk of falls [6].

The ability to maintain one's balance is fundamental in such daily activities as transfers and walking and is, therefore, of great importance to stroke patients [6]. In this order, balance could play an important role in the daily mobility of the stroke patient, especially in

essential self-care and mobility activities, such as ADLs. The objective of this study was to determine if dynamic balance is related to ADL dependence in stroke patients.

Materials and Methods

Design

This is a cross-sectional study. A non-probability convenience sampling was used to select all the patients who met the following inclusion criteria: (a) stroke diagnosis, (b) 20-80 years and (c) Standing capacity with/without technical assistance. On the other hand, the exclusion criteria were: (a) stroke with other neurological condition (b) visual and auditory alteration, (c) history of peripheral nerve injuries, and (d) history of fractures and orthopedic surgeries. This study followed the Declaration of Helsinki and was approved by *Comité de Bioética de la Facultad de Ciencias de la Salud from Pontificia Universidad Católica Madre y Maestra* (ID: COBE-FACS-EXT-001-3-2016-2017).

Outcome Measures

Barthel Index (BI). Its main objective is to evaluate ADLs performance in patients with disabilities. The popularity of this

questionnaire to assess ADL in stroke patients has been confirmed. The BI contains 10 items that determine dependence in the following ADLs: feeding, dressing, grooming, bathing, bowels, bladder, toilet use, transfer/chair-bed and back, mobility and stairs. The total score can range from 0 to 100 points; lower scores would indicate greater dependence on the ADLs [7].

Timed Up and Go Test (TUG). The TUG is a test that assesses functional mobility, dynamic balance and the risk of falls [8]. It measures the time taken (in seconds) for a person to rise from a chair with armrests, walk 3 meter with usual assistive devices, turn, return to the chair, and sit down. Evidence has recommended this test because it evaluates mobility and balance in 4 specific daily sequential activities: sit-to-stand, gait, 180° turning, and stand-to-sit. The TUG has shown to be valid to assess functional mobility and to identify stroke patients with various degrees of disabilities [9].

Four Square Step Test (FSST). The FSST is a timed measure (in seconds) that requires individuals to step over canes placed in a crosswise pattern on the floor, thereby creating four quadrants [8,10]. In the present study we use the sequence recommended by the evidence: the participant's starting position is in square 1 facing square 2. Then, the participant starts by stepping forward, to the right, backward, and to the left into each quadrant in the clockwise direction, followed by the reverse

sequence in the counterclockwise direction (ie, the sequence 2, 3, 4, 1, 4, 3, 2, 1) [11]. Evidence has suggested that FSST is a valid test to assess dynamic balance in stroke patients [11, 12].

Statistical analysis

The data was analyzed in the IBM SPSS Statistics 23 program. A descriptive analysis and a Spearman correlation were performed assuming the abnormal distribution of the data, confirmed by a Kolmogórov-Smirnov test. The level of significance considered was $p < 0.05$.

Results and Discussion

Table 1 shows the general characteristics of the patients and the performance in the TUG and the FSST. On the other hand, the results corroborated inverse correlations between BI and performance in all TUG and FSST trials; this reflects that a worse performance in TUG and FSST (Poor dynamic balance) in stroke patients is correlated with a higher dependence on ADLs (**Table 2**). These correlations were also found between performance of both balance tests and dependence on ADLs, such as bathing, moving, and going up and down stairs. It should be noted that, in contrast to TUG, inverse correlations were estimated between the ADL related to dressing and the performance of the FSST.

Variable		N	%	Mean	Min-max	Standard deviation
Sex	Male	33	53.2			
	Female	29	46.8			
Age	≤55 years	31	50.0	56.60	20 - 80	12.66
	>55 years	31	50.0			
Formal education	1-8 years	37	59.7			
	9-12 years	12	19.4			
	≥13 years	13	21.0			
Poststroke duration	0-6 months	35	56.5	12.66	1 - 84	17.16
	>6 months	27	43.5			
Side of hemiparesis	Left	29	46.8			
	Right	33	53.2			
BI				78.15	15-100	14.06
TUG (Seconds)			FSST (Seconds)			
Trial 1	Trial 2	Trial 3	Trial 1	Trial 2	Trial 3	Trial 4
20.71	17.91	16.76	35.61	28.57	25.53	23.57

Table 1. Characteristics of the study population and performance in TUG and FSST (N = 62). BI: Barthel Index; TUG: Timed Up and Go Test; FSST: Four Square Step Test.

	TUG Trials			FSST trials			
	Trial 1 ^a	Trial 2 ^a	Trial 3 ^a	Trial 1 ^a	Trial 2 ^a	Trial 3 ^a	Trial 4 ^a
BI Global	-0.383**	-0.390**	-0.377**	-0.345**	-0.365**	-0.358**	-0.391**
Feeding	-0.130	-0.133	-0.105	-0.057	-0.094	-0.089	-0.102
Dressing	-0.216	-0.167	-0.143	-0.245	-0.296*	-0.263*	-0.273*
Grooming	-0.015	-0.049	0.020	0.054	0.010	-0.025	-0.037
Bathing	-0.453**	-0.501**	-0.477**	-0.486**	-0.475**	-0.455**	-0.508**
Bowels	0.229	0.217	0.211	0.115	0.084	0.126	0.154
Bladder	0.053	0.060	0.034	0.023	-0.053	-0.008	0.020
Toilet use	-0.068	-0.071	-0.048	-0.171	-0.147	-0.101	-0.109
Transfer	-0.141	-0.130	-0.165	-0.101	-0.083	-0.091	-0.143
Mobility	-0.499**	-0.468**	-0.461**	-0.382**	-0.274*	-0.299*	-0.318*
Stairs	-0.403**	-0.442**	-0.474**	-0.342**	-0.393**	-0.414**	-0.434**

Table 2. Correlation between ADL and performance in TUG and FSST (N=62)

ADL: activities of daily living; BI: Barthel Index; TUG: Timed Up and Go Test;

FSST: Four Square Step Test; ^a: Spearman correlation; *: p< 0.05; **: p<0.01.

This difference could be explained considering that FSST, compared to TUG, requires higher motor and cognitive demands [11-13]. Although ADLs require cognitive skills, the activity of dressing may require greater demands. A study suggests that independence in activities such as dressing requires not only balance components, but also good cognitive functions [3].

Considering that TUG and FSST assess dynamic balance, it could be clinically inferred that patients with a decrease in these abilities would eventually have greater difficulties with ADL. In the framework of stroke, researchers consider balance as a fundamental component for independence in ADL, as well as locomotion, functional capacity and fall prevention [5, 14]. In addition, another study indicates that impaired balance after a stroke greatly influences ADLs, gait, social participation and general health ⁴.

Some authors have studied dynamic balance in relation to daily activities in stroke patients. A study in older adults with stroke showed that TUG performance is the best predictor of mobility and participation in daily activities [15]. Furthermore, another study found correlations between the Berg balance scale and ADL functionality measured by BI in 105 stroke patients ($r = 0.46$) [14].

On the other hand, an investigation applied the FSST in 37 patients with stroke and found that 38% considered this test very relevant to daily life. The authors emphasize that the FSST contains tasks relevant to daily life, as its instructions require skills such as stepping over objects and turning [12]. Another study evaluated 30 stroke patients discharged from their rehabilitation services. During a 6 and 36 month follow-up, the authors observed that the patients with the worst balance, as determined by the FSST, were those who avoided mobility tasks at home and in their community [13].

It can be seen that the findings in the previous studies follow a similar trend with the correlations found in the present study. Certainly, the performance of the TUG and the FSST shows an important relationship with dependence in ADLs. Dynamic balance assessment, especially with TUG and FSST, can offer important contributions to identify patients who may eventually be experiencing ADL dependence.

Conclusions

The Dynamic balance evaluated by the TUG and the FSST showed correlations with the ADL dependency measured with the BI. The close relationship between TUG and FSST with performance in daily tasks was found to be an accurate functional evaluation of the stroke patient. The manuscript is a contribution to the field and is consistent with recent references aspects of a patient's balance deficits to better guide treatment and intervention.

Source of funding

The author(s) received no specific funding for this work.

Disclosure of interest

No conflict of interest has been declared by the author(s).

References

1. Cioncoloni D, Martini G, Piu P, Taddei S, Acampa M, Guideri F, et al (2013) Predictors of long-term recovery in complex activities of daily living before discharge from the stroke unit. *Neurorehab.* 33(2):217–223.
2. Kong K-H, Lee J (2014) Temporal recovery of activities of daily living in the first year after ischemic stroke: a prospective study of patients admitted to a rehabilitation unit. *Neurorehab.* 35(2):221–226.

3. De Wit L, Putman K, Devos H, Brinkmann N, Dejaeger E, De Weerd W, et al (2014) Long-term prediction of functional outcome after stroke using single items of the Barthel Index at discharge from rehabilitation centre. *Disab Rehab.* 36(5):353-358.
4. Januário F, Campos I, Amaral C. (2010) Rehabilitation of postural stability in ataxic/hemiplegic patients after stroke. *Disab Rehab.* 2010; 32(21): 1775-9.
5. Liphart J, Gallichio J, Tilson JK, Pei Q, Wu SS, Duncan PW (2016) Concordance and discordance between measured and perceived balance and the effect on gait speed and falls following stroke. *Clin Rehab.* 2016; 30(3): 294-302.
6. Pählman U, Gutiérrez Pérez C, Sävborg M, Knopp E, Tarkowski E (2011) Cognitive function and improvement of balance after stroke in elderly people: the Gothenburg Cognitive Stroke Study in the Elderly. *Disab Rehab.* 33(21-22): 1952-1962.
7. Duffy L, Gajree S, Langhorne P, Stott DJ, Quinn TJ (2013) Reliability (Inter-rater Agreement) of the Barthel Index for Assessment of Stroke Survivors: Systematic Review and Meta-analysis. *Stroke.* 44(2):462-468.
8. Nicole Dawson, Darcy Dzurino, Melissa Karleskint, and Jennifer Tucker (2018) Examining the reliability, correlation, and validity of commonly used assessment tools to measure balance. *Health Sci Rep.* 1(12): e98.
9. Faria CDCM, Teixeira-Salmela LF, Nadeau S (2013) Predicting levels of basic functional mobility, as assessed by the Timed “Up and Go” test, for individuals with stroke: discriminant analyses. *Disab Rehab.* 35(2):146-152.
10. Martha Moore and Karen Barker (2017) The validity and reliability of the four square step test in different adult populations: a systematic review. *Syst Rev.* 6: 187.
11. Goh EY, Chua SY, Hong ZJ, Ng SS (2013) Reliability and Concurrent Validity of Four Square Step Test Scores in Subjects With Chronic Stroke: A Pilot Study. *Arch Phys Med Rehabil.* 94: 1306-1311.
12. Blennerhassett JM, Jayalath VM (2008) The Four Square Step Test is a Feasible and Valid Clinical Test of Dynamic Standing Balance for Use in Ambulant People Poststroke. *Arch Phys Med Rehabil.* 89(11):2156-2161.
13. Blennerhassett JM, Dite W, Ramage ER, Richmond ME (2012) Changes in Balance and Walking From Stroke Rehabilitation to the Community: A Follow-Up Observational Study. *Arch Phys Med Rehabil.* 2012; 93(10): 1782-7.
14. Kim JH, Park EY (2014) Balance self-efficacy in relation to balance and activities of daily living in community residents with stroke. *Disab Rehab.* 2014; 36(4): 295-299.
15. Paquet N, Desrosiers J, Demers L, Robichaud L (2009) Predictors of daily mobility skills 6 months post-discharge from acute care or rehabilitation in older adults with stroke living at home. *Disab Rehab.* 31(15): 1267-1274.



This work is licensed under Creative Commons Attribution 4.0 License

To Submit Your Article Click Here: [Submit Article](#)

DOI: [10.31579/2690-1919/103](https://doi.org/10.31579/2690-1919/103)

Ready to submit your research? Choose Auctores and benefit from:

- ❖ fast, convenient online submission
- ❖ rigorous peer review by experienced research in your field
- ❖ rapid publication on acceptance
- ❖ authors retain copyrights
- ❖ unique DOI for all articles
- ❖ immediate, unrestricted online access

At Auctores, research is always in progress.

Learn more www.auctoresonline.org/journals/journal-of-clinical-research-and-reports