DOI: 10.1590/1809-2950/17025025022018

ORIGINAL RESEARCH

Trunk control and its relation with clinical condition, central anatomic area and post-cerebrovascular accident phase

Controle de tronco e sua relação com quadro clínico, área comprometida e fase pós-acidente vascular encefálico

Control de tronco y su relación con cuadro clínico, área comprometida y fase post-accidente vascular encefálico

Tamise Aguiar Caires[1], Gislaine Valeria Silva[2], Shamyr Sulyvan de Castro[3], Luciane Aparecida Pascucci Sande de Souza[4]

ABSTRACT | The objective of the study was to characterize cerebrovascular accident patients, correlating the findings of the Trunk Impairment Scale (TIS) with the location of the lesion, age, clinical condition and stage of evolution. 78 patients were evaluated through TIS and the characterization, with analysis of the following data: type of stroke, stage of the disease; clinical condition; compromised brain area; sex and risk factors. The results show that there was no relation between the TIS score and the other variables. These findings lead us to conclude that trunk control may be something very particular, therefore, requiring a specific evaluation in cases of stroke, and the TIS may be a possible instrument for such purpose. The characterization variables tested were not determinants of typical patterns of postural control.

Descriptors | Stroke; Rehabilitation; Trunk.

RESUMO | O objetivo deste estudo é caracterizar pacientes com acidente vascular encefálico (AVE), correlacionando as pontuações da escala de equilíbrio de tronco (EDT) com a área da lesão, idade, o quadro clínico e seu estágio de evolução. Foram avaliados 78 pacientes por meio da EDT e da caracterização, com análise dos seguintes dados: tipo de AVE, fase da doença, quadro clínico, área cerebral comprometida, sexo e fatores de risco. Os resultados mostram que não houve relação entre a pontuação da EDT e as demais variáveis. Estes achados levam a concluir que o controle de tronco pode ser algo bastante particular que, portanto, requer uma avaliação específica nos casos de AVE, e a EDT pode ser uma ferramenta para tal finalidade. As variáveis de caracterização testadas não foram fatores determinantes de padrões típicos de controle postural.

Descritores | Acidente Vascular Cerebral; Reabilitação; Tronco.

RESUMEN | El objetivo de este estudio es caracterizar pacientes con accidente vascular encefálico (AVE), relacionando las puntuaciones de la escala de equilibrio de tronco (EDT) con el área de la lesión, edad, el cuadro clínico y su etapa de evolución. Se evaluaron 78 pacientes por medio de la EDT y la caracterización, con análisis de los siguientes datos: tipo de AVE, fase de la enfermedad, cuadro clínico, área cerebral comprometida, género y factores de riesgo. Los resultados muestran que no hubo relación entre la puntuación de EDT y las demás variables. Estos hallazgos llevan a concluir que el control de tronco puede ser algo muy particular que, por lo tanto, requiere una evaluación específica en los casos de AVE, y la EDT puede ser una herramienta para ello. Las variables de caracterización probadas no fueron factores determinantes de patrones típicos de control postural.

Palabras clave | Accidente Cerebrovascular; Rehabilitación; Tronco.

[1]Master's student in Physical Therapy by Universidade Federal do Triângulo Mineiro, Uberaba (MG), Brazil.
[2]Master in Sciences by Universidade Federal do Rio de Janeiro, Rio de Janeiro (RJ), Brazil.
[3]Ph.D., professor of the Department of Physical Therapy of the Universidade Federal do Ceará, Fortaleza (CE), Brazil.
[4]Ph.D., professor of the Department of Physical Therapy of the Universidade Federal do Triângulo Mineiro, Uberaba (MG), Brazil.

Corresponding address: Tamise Aguiar Caires – rua Nicola Herculi, 761, Jardim Nossa Senhora Aparecida – Ibaté (SP), Brazil – Zip code: 14815-000 – E-mail: tamiseaguiar@hotmail.com –
Funding: Fundação de Amparo à Pesquisa de Minas Gerais – Conflict of interest: Nothing to declare – Presentation: Nov. 5th, 2017 – Accepted for publication: Mar. 30th, 2018 – Approved by the Research Ethics Committee of the Universidade Federal do Triângulo Mineiro under the opinion 1647/2013.

INTRODUCTION

The control and use of selective trunk activity in patients with sequelae from a cerebrovascular accident (CVA) are very impaired[1]. Furthermore, strong evidence claiming that trunk control is one of the predictors of functional improvement after the CVA exists[2,3]. This is more evident when we consider that poor trunk balance after CVA can impact the recovery of global functioning[1]. Thus, by correlating trunk balance and functional activities, including the activities of daily living (ADL), we can observe a relation between these variables when assessing individuals during the outpatient phase of treatment for the first four weeks, indicating the great importance of trunk balance in performing the ADL[4].

The trunk can be evaluated using different instruments, such as the force evaluation using a portable dynamometer and modified sphygmomanometer; muscle activation through electromyography; symmetry through kinematics or other postural assessments. The literature presents several instruments to evaluate the trunk in hemiparesis[2,5-7].

However, the trunk impairment scale (TIS) is the only instrument that assesses, separately, the upper and lower trunk function of patients with sequelae from CVA, as well as featuring tasks progressively organized in degree of difficulty, thus, following the hierarchy of acquisition of motor function of the trunk; in addition, this instrument is found translated and validated for the Brazilian population[8]. Based on this, we started from the study of Verheyden et al.[5] on the development of the TIS, a comprehensive instrument to assess trunk motor function post-CVA. The TIS showed reliability, internal consistency and validity, thus, being an important instrument for the evaluation of trunk dysfunction post-stroke[5].

In Brazil, the TIS was validated and named *escala de equilíbrio de tronco* (EDT) by Castellassi et al.[8], showing high inter-examiner reliability, with a 0.96 intraclass correlation coefficient, indicating a correlation between examiners close to the maximum value, which is 1. In addition, the instrument presented high internal consistency, achieving a value of 0.86[8], thus, greater than 0.7, a great correlation between the various TIS items. However, there are very few studies in the Brazilian literature using the Brazilian version of the TIS[9-13].

The objective of this study was to characterize patients with CVA, correlating the finds of the TIS with the location of the lesion, age, clinical condition and its stage of evolution. The hypotheses consider that the worst TIS scores are related to large injury areas, greater sensory-motor impairments in the clinical condition, older individuals and individuals at the subacute stage post-stroke.

METHODOLOGY

This study evaluated patients cared for in the *Ambulatório Maria da Glória* of the University Hospital of the *Universidade Federal do Triângulo Mineiro* (UFTM), in Uberaba (MG), from 2010 to 2013, with diagnosis of ischemic or hemorrhagic CVA, in the acute phase (first six months post-ictus) or chronic (after this period), showing clinical picture of paresis or palsy evaluated by the Fugl-Meyer[14] scale.

The sample was composed by 78 patients who were evaluated by the TIS, which analyzes the impairment of trunk control. Furthermore, these patients were characterized analyzing the following data: type of CVA, stage of the disease, clinical condition, sex and risk factors.

The TIS is composed by 17 items divided into 3 subscales comprising the static sitting balance (SSB) and dynamic sitting balance (DSB) and coordination (coord.). The SSB subscale has three items used to assess the ability of the individual to remain seated without hand support, as well as the ability to passively cross the healthy lower limb. The DSB subscale presents ten items that assess the lateral flexion of the trunk by touching the elbow on the litter and elevating the pelvis on both sides (palsy and healthy). The coord. subscale consists of four items to evaluate upper and lower trunk rotation. The maximum score of each subscale is seven, ten and six, respectively. The total score ranges from 0 to 23, 0 being the worst trunk function and 23 the best[8].

The data were organized and analyzed using the software Microsoft Office Excel 2007. Statistical analysis was performed using the Stata 13 program. For the variables sex, hypertension (SAH), diabetes mellitus (DM) and recovery time post-CVA (stage), the Student's T-test was used. Analysis of variance (one-way ANOVA) was used for the other variables – smoking, type of CVA, alcohol consumption and clinical condition. In addition, Spearman's correlation test was used to correlate the location of the lesion and the total TIS score. The variables were analyzed through percentage.

RESULTS

Table 1 shows the characterization of individuals with absolute frequencies, means and standard deviation of the analyzed variables. The results of mean and standard deviation of the subscales and of the total TIS score are shown in Figure 1. The great variability in scores obtained can be seen through the standard deviation, for SSB the mean obtained was 5.23 (± 2.09), 6.23 (± 3.55) for DSB, 2.91 (± 2.46) for coord. and total score of 14.37 (± 7.05). Statistical analysis found no significant differences for the variables analyzed. The variables did not interfere in the scale score, most likely due to its specificity. Only DM and SAH showed significance in two subscales, in sitting static balance ($p = 0.0454$) and coordination ($p = 0.0467$), respectively.

Regarding the findings on injury location, we found incomplete data in many records, and in 25.3% of the cases, the reports of complementary examinations was illegible or little detailed. Only 3.79% showed normality patterns in their TC. Considering the ischemic lesions, which correspond to 87.35% of the cases, 18.84% had impairment of ACM, with hypodensity and edema in its formation, and 14.49% suffered ischemic injuries in basal ganglia and internal capsule. The other areas and reports were very varied, corresponding to only 1.45% each. For hemorrhagic cases (7.9%), the vast majority 70%) compromised the basal ganglia, 10% involved the thalamus, and 30% had bleeding extension to the ventricular system.

No relation was found between the location of injury and the TIS score.

Table 1. Characterization of the individuals

Characterization of the individuals	
Analyzed variables	n or mean (± standard deviation)
Male	46
Age	60.53 ± 14.63
Type of CVA, isch/hem/did not know to inform or was not listed in the record	60\13\5
Involvement, paresis/palsy/no impairment	47\23\7
Modifiable factors, smoker/used to smoke, consumed alcohol/used to consume	17\21\16\8
Non-modifiable factors, SAH/DM	63\21

F/M: female/male; CVA: cerebrovascular accident; isch/hem: ischemic/hemorrhagic; SAH/DM: systolic arterial hypertension/diabetes mellitus

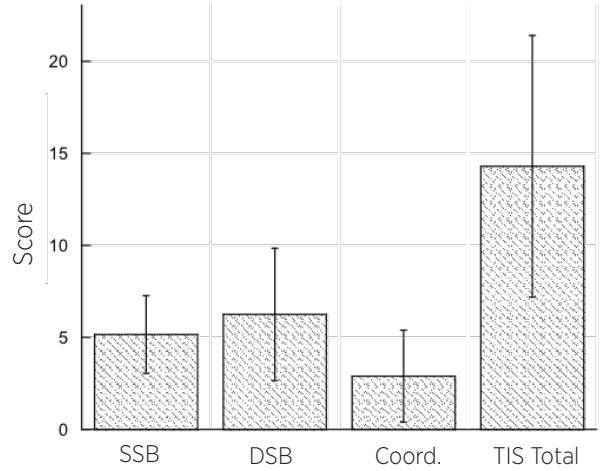

Figure 1. Trunk impairment scale (TIS) scores

Mean and standard deviation obtained in the application of the TIS, including the scores from the subscales SSB: static sitting balance; DSB: dynamic sitting balance; Coord.: coordination; and Total TIS

DISCUSSION

According to the objective proposed in this study and observing the results, there was no relation between the TIS score, clinical condition, its evolution, some characteristics of the individuals and the findings from imaging exams.

One of the explanations for this finding is that, despite its predictive impact on functional independence[15], the purpose of the TIS is only to evaluate sitting balance post-CVA, which includes the static and dynamic balance and trunk coordination in such position[1]. Therefore, changes in different variables did not interfere in its score, such as age, sex, types of CVA, clinical condition, compromised areas and the stage in which the patient was found during the evaluation (acute or chronic).

Such finding leads to a major reflection on the impact of CVA in trunk control, since in different clinical circumstances, this control was found to still be impaired. Kim et al.[4] found a high correlation between the ADL index and the TIS score only for the acute phase; over time, the variability in the evolution of the acute picture generated diverse results.

According to Hsieh et al.[3], trunk control is an important predictor of the ability to perform ADL, and its early assessment is recommended. Therefore, the evaluation of trunk control may be a better indicator of functional improvements and, in chronic cases, it may have a good correlation with tests that involve activities of daily living.

This control does not seem to be age-dependent, because despite the hypothesis of a greater impairment in more advanced ages, this did not occur in every case. In this sample there were younger individuals with serious impairments and older individuals with milder impairments. We did not formulate any hypotheses regarding sex, and the data presented shows that this variable also did not interfere in trunk control post-CVA. Regarding hemorrhagic CVA, which is very feared and impacting, it did not contribute to more pronounced impairments during sitting balance.

The clinical condition, considered in this study as palsy, paresis and absence of involvement, also contributed to significant changes in postural control, as hypothesized at first. This leads us to consider the functions of the medial and lateral descending motor pathways. The impairment on each function seems to be distinct after a brain and/or cerebellar lesion[4]. This implies that there are patients with palsy in limbs and a good postural control, and cases of paresis, even mild, with low balance in sitting position. Similarly, the stage of the disease did not affect the results significantly, as we had presupposed. Sometimes a patient in the acute stage presents a good trunk control, while other who is already considered chronic still presents a serious impairment in such control.

Expanding the analysis of these data, we inferred that many areas contribute to postural control after considering that no relation between the location of the lesion and the TIS score was found. Therefore, in different injuries and varied locations, the control may be impaired in different ways. There are findings on neural representations of a secondary graviceptive system in the human thalamus, which is responsible for maintaining the erect posture[16]. We must mention that extensive lesions and more proximal lesions present great impacts on trunk control when compared to lesions in more distal artery branches, thus, influencing the overall clinical picture.

Although it was not considered in this study and it may be a limitation, the permanence of the patients in physical therapy may interfere in trunk control. According to some authors, this function is stimulated to inhibit stagnation in functional improvements, which is common from 3 to 6 months after CVA[1]. Our results show data on the patients that underwent or not, physical therapy during hospitalization, due to the lack of data on the records. However, based on the study of Valdés et al.[17], we can confirm the importance of physical therapy for these patients, seeking trunk balance. We must note that, in this study, the number of participants and the heterogeneity in the CVA lesions probably resulted in a weaker sample. New studies, with stratification by the level of impairment, should be performed to support the findings presented.

CONCLUSION

From the characterization of the participants of this study we can conclude that trunk control seems to be something very particular, therefore, requiring a specific assessment in CVA cases, since the location of the lesion, the clinical condition, age and even the time were not determining factors of typical patterns of postural control. The TIS was shown to be effective in this evaluation, and we consider that it should be used at several moments, following the evolution of the clinical picture post-CVA.

REFERENCES

1. Verheyden G, Nieuwboer A, De Wit L, Thijs V, Dobbelaere J, Devos H, et al. Time course of trunk, arm, leg, and functional recovery after ischemic stroke. Neurorehabil Neural Repair. 2008;22(2):173-9. doi: 10.1177/1545968307305456.
2. Duarte E, Marco E, Muniesa JM, Belmonte R, Diaz P, Tejero M. et al. Trunk control test as a functional predictor in stroke patients. J Rehabil Med. 2002;34(6):267-72. doi: 10.1080/165019702760390356.
3. Hsieh CL, Sheu CF, Hsueh IP, Wang CH. Trunk control as an early predictor of comprehensive activities of daily living function in stroke patients. Stroke. 2002;33(11):2626-30. doi: 10.1161/01.STR.0000033930.05931.93.
4. Kim TJ, Seo KM, Kim D, Kang SH. The relationship between initial trunk performances and functional prognosis in patients with stroke. Ann Rehabil Med. 205;1(39):66-73. doi: 10.5535/arm.2015.39.1.66.
5. Verheyden G, Nieuwboer A, Mertin J, Preger R, Kiekens C, De Weerdt W. The trunk impairment scale: a new tool to measure motor impairment of the trunk after stroke. Clin Rehabil. 2004;18(3):326-34. doi: 10.1191/0269215504cr733oa.
6. Benaim C, Pérennou D, Villy J, Rousseaux M, Pelissier J. Validation of a standardized assessment of postural control in stroke patients: the postural assessment scale for stroke patients (PASS). Stroke. 1999;30(9):1862-8. doi: 10.1161/01.STR.30.9.1862.
7. Nieuwboer A, Feys H, De Weerdt W, Nuyens G, De Corte E. Developing a clinical tool to measure: sitting balance after stroke: a reliability study. Phys Ther. 1995;81(8):439-45. doi: 10.1016/S0031-9406(05)66720-X.

8. Castellassi SC, Ribeiro FAE, Fonseca VC, Beinotti F, Oberg DT, Lima VFMN. Confiabilidade da versão brasileira da escala de deficiências de tronco em hemiparéticos. Fisioter Mov. 2009;22(2):189-99.

9. Soriano SFF, Baraldi K. Escalas de avaliação funcional aplicáveis a pacientes pós acidente vascular encefálico. ConScientiae Saúde. 2010;9(3):521-30. doi: 10.5585/conssaude.v9i3.2227.

10. Siqueira CMR, Frazão SV, Lopes DSR, Petillo CP. A. Influência da intervenção fisioterapêutica no controle de tronco em portadores de hemiplegia. ConScientiae Saúde. 2011;10(3):500-7. doi: 10.5585/ConsSaude.v10i3.2545.

11. Raimundo CK, Silveira SL, Kishi SM, Fernandes MRFL, Souza SPAL. Análise cinemática e eletromiográfica do alcance em pacientes com acidente vascular encefálico. Fisioter Mov. 2011;24(1):87-97. doi: 10.1590/S0103-51502011000100010.

12. Pedebos MB, Porto BL, Copetti CF, Balk SR. Avaliação do controle postural e sua relação com o hemisfério acometido em pacientes com acidente vascular cerebral praticando equoterapia. Fisioter Bras. 2014;15(1):22-8. doi: 10.13140/RG.2.1.2762.1928.

13. Silva SFP. Cinemática e desempenho muscular do tronco e a atividade de sentado para de pé em indivíduos pós-acidente vascular encefálico e saudáveis. [dissertação]. Minas Gerais: Universidade Federal de Minas Gerais; 2014.

14. Maki T, Quagliato EMAB, Cacho EWA, Paz LPS, Nascimento NH, Inoue MMEA, et al. Estudo de confiabilidade da aplicação da escala de Fugl-Meyer no Brasil. Rev Bras Fisioter. 2006;10(2):177-83. doi: 10.1590/S1413-35552006000200007.

15. Michaelsen MS, Rocha AS, Knabben JR, Rodrigues PL, Fernandes CGC. Tradução, adaptação e confiabilidade interexaminadores do manual de administração da escala de Fugl-Meyer. Rev Bras Fisioter. 2011;15(1):80-8. doi: 10.1590/S1413-35552011000100013.

16. Likhi M, Jidesh VV, Kanagaraj R, George JK. Does trunk, arm, or leg control correlate best with overall function in stroke subjects? Top Stroke Rehabil. 2013;20(1):62-7. doi: 10.1310/tsr2001-62.

17. Valdés CR, Bagur-Calafat C, Girabent-Farrés M, Caballero-Gómez FM, du Port Pontcharra-Serra H, German-Romero A, et al. Long-term follow-up of a randomized controlled trial on additional core stability exercises training for improving dynamic sitting balance and trunk control in stroke patients. Clin Rehabil. 2017;31(1):1492-99. doi: 10.1177/0269215517701804.