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ORIGINAL ARTICLE

Trunk Control Scales as functional predictors for stroke patients

Escalas de controle de tronco como prognóstico funcional em pacientes após acidente vascular encefálico

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ABSTRACT

According to the World Health Organization (WHO), stroke is considered a syndrome with a rapid development of clinical signs of focal or global disturbance of cerebral function, of which origin is possibly vascular and lasting more than 24 hours. In addition to deficits in limb movement, gait, and language, the stroke may also cause impaired control of trunk mobility, which is an important issue. Therefore, the aim of this literature review was to identify, through the use of scales, the association between trunk control impairment and functional disability in hemiparetic patients after a stroke. A literature review was carried out and eight clinical, longitudinal and descriptive articles were selected. All the studies showed a prognostic association between trunk control and functional abilities. Trunk Control Test (TCT), Trunk control items of the Postural Assessment Scale for Stroke Patients (PASS-TC) and Trunk Impairment Scale (TIS) (Fujiwara and Verheyden) were used in the assessments. It was concluded that the clinical evaluation of trunk control, through the use of scales, is an important tool for the prognosis of the functional capacity of hemiparetic patients after a stroke and for the planning of a specific and differentiated treatment of these patients. However, there few studies proved this association, as different scales were used and there was no consensus among authors. Additionally, there is no agreement on the data regarding the evaluation of balance and gait.

KEYWORDS

stroke, paresis, evaluation, gait, quality of life

RESUMO

De acordo com a Organização Mundial de Saúde (OMS), o acidente vascular encefálico (AVE) é considerado uma síndrome com desenvolvimento rápido de sinais clínicos de perturbação focal ou global da função cerebral, com possível origem vascular e com mais de 24 horas de duração. Além de o AVE causar déficits no movimento dos membros, marcha e linguagem, o déficit de controle da mobilidade do tronco é também um problema muito importante. O Objetivo deste estudo foi identificar a relação entre a alteração no controle de tronco, através de escalas, e incapacidade funcional de pacientes hemiparéticos após AVE. Foi realizado um estudo de revisão de literatura através do acesso aos indexadores de produção científica, sendo selecionados oito artigos clínicos, longitudinais e descritivos. Todos os autores observaram relação prognóstica entre o controle de tronco e habilidades funcionais. As escalas utilizadas foram a Trunk Control Test (TCT), Postural Assessment Scale for Stroke Patients (PASS-TC) e Trunk Impairment Scale (TIS) (Fujiwara e Verheyden). Concluiu-se que a avaliação clínica do controle de tronco, através das escalas, constitui uma ferramenta importante para o prognóstico das habilidades funcionais de pacientes hemiparéticos após AVE, e para o planejamento de um tratamento específico e diferenciado para esses pacientes. Entretanto, há poucos estudos comprovando esta relação, sendo que estes utilizaram diferentes escalas, não havendo um consenso entre os autores. Além das escalas, não há concordância nos dados para a avaliação do balance e marcha.

PALAVRAS-CHAVE

acidente cerebral vascular, hemiparesia, avaliação, marcha, qualidade de vida

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INTRODUCTION

According to the World's Health Organization (WHO), the cerebrovascular accident (CVA) is considered a syndrome with "rapidly developing clinical signs of focal or global disturbance of cerebral function, with possible vascular origin and lasting more than 24 hours". It is a condition that presents high incidence in developed countries, where it is considered as one of the main causes of disability. The sequelae of a CVA are variable and can be sensitive, motor and/or cognitive, generating deficits in functional capacity, independence and quality of life (QoL) of the individuals.[1]

In addition to causing deficits in limb movement, gait and language, the trunk movement control deficit is also a very important problem.[2] All normal functional activities depend on normal trunk control as the base for movement.[3] The trunk muscular function is an essential factor for balance, transferences, gait and several functions.[4] Thus, the trunk must provide, simultaneously, stability and mobility so that the individuals can perform their daily activities.[3]

The posture of the whole trunk, including the pelvis, affects the scapula (shoulder blade) and the collarbone, which, on the other hand, exercise a direct effect, muscular as well as biomechanical, on all upper extremity movements. Therefore, the upper-limb movements are highly dependent on trunk control and posture.

In hemiparetic patients, even when they have a motor return and a normal upper-limb sensibility, the movement will not be normal if the trunk is not capable of performing the necessary functional control.[5]

The lower-limb (LLLL) function also depends on the trunk. Several studies have reported a correlation between gait performance in hemiparetic patients after a CVA and motor recovery and muscular strength. Bohannon suggested that the motor control is one of the best prognostic factors for gait performance.[6] Additionally, the trunk control is a vital component for the performance of the activities of daily living (ADL). Some authors have demonstrated that the trunk control or balance in the sitting position at an early stage can influence the ADL outcome at a later stage of the CVA.

Reducing the degree of functional dependence is one of the main objectives of rehabilitation programs. The earlier the prognosis of functional activities, such as ADL, is defined, the higher is the possibility of selecting adequate treatment programs and anticipating the need for adjustments at home and community support.[7]

Several authors have analyzed trunk performance after a CVA through different measures, such as isokinetic muscular test, manual dynamometer, electromyography analysis, transcranial electrical stimulation and analysis of movement. There are only a few clinical assessment tools that have been published in the literature to evaluate trunk performance.[8,9]

OBJECTIVE

The objective of the present study was to identify, through the use of scales, the association between trunk control alteration and functional disability in hemiparetic patients after a CVA.

METHOD

This is a literature review study, carried out through access to scientific production indexing tools such as Lilacs, Medline, Scielo, Pubmed and Capes Journals. The research was carried out from February to October 2007, and the following key words were used in the search: AVE (CVA), tronco (trunk), funcao (function), balance, in both Portuguese and English languages.

The search included clinical articles, systematic reviews and meta-analyses published from 1996 to 2007, in Portuguese and English languages, which used scales to evaluate trunk control of hemiparetic patients after a CVA, correlating it to the patient's functional disabilities. Articles that evaluated either trunk control or functional disabilities, separately, were excluded, as well as those that studied the biomechanical aspects, only.

RESULTS

Twenty articles were obtained, of which 11 were excluded: 8 for addressing only the trunk muscular dysfunctions after the CVA, without correlating them to the functional disabilities; two for using other measurement tools rather than scales as functional prognostic factors; one for analyzing the functional response of patients after the CVA after a specific treatment for the trunk. Thus, 8 clinical, longitudinal and descriptive studies (Table 1) and one systematic review remained.

DISCUSSION

All of the authors observed a prognostic association between trunk control and functional capacity, with no uniformity regarding the evaluation measures of both variables. Different scales (Table 2) were used, such as the Trunk Control Test (TCT), consisting of 4 items and the Postural Assessment Scale for Stroke Patients (PASS-TC), consisting of 5 items (sitting up without support, rolling onto the affected side, go from the supine position to the sitting position and vice-versa), with the four first ones being quite similar to the TCT. Other scales used included the two Trunk Impairment Scale (TIS) (Fujiwara and Verheyden). Fujiwara's TIS consists of the following items: maintenance and perception of the vertical posture, straightening reflex, rotation muscular strength on the affected and non-affected sides and abdominal muscular strength according to the Stroke Impairment Assessment Set (SIAS). Verheyden's TIS evaluated the sitting trunk control (observing whether the patient can remain seated with LLLL placed on the floor and with the legs crossed, both passively by the therapist, as well as actively by the patient – observing trunk compensations); dynamic trunk control (lateral flexion, initiated at the scapular and pelvic waists) and coordination (selectively assessing upper and lower trunk rotation). The TCT was used separately[8,10] as well as in combination with other scales.[11,12]

Verheyden et al[13] carried out a systematic review of the clinical

Table 1
Description of the articles according to the trunk and functional assessments and outcome presentation.

Author/Year	Trunk Control Assessment	Functional Assessment	Conclusion
Wang et al., 2005	PASS-TC	BI and FAI(CADL)	PASS-TC showed to be a prognostic factor for CADL, one year after the CVA.
Hsieh et al., 2002	PASS-TC	BI and FAI(CADL)	The prognostic value of trunk control in CADL was confirmed at the initial phase after the CVA in up to six months. The trunk assessment and treatment are recommended at this phase.
Verheyden et al., 2006	Verheyden 's TCT and TIS	Tinetti Scale (balance and gait), FAC (level of dependence during gait); Time required to walk 10m, Time Up and Go test and Motor -FIM	The strong association between trunk performance with balance, gait and functional capacity measures supports the importance of trunk rehabilitation.
Duarte et al., 2002	TCT and CV	FIM and Motor FIM, FIM and Motor FIM gain, motor efficiency, gait velocity (distance of 10m), static and dynamic balance at walking (posturography) and balance through BBS	The TCT correlates well with some specific motor results, such as gait velocity, distance walked and balance, measured by computerized systems such as posturography or clinical scales such as BBS.
Franchignoni et al., 1997	TCT	FIM	The high correlation between the TCT and the Motor FIM and Total FIM demonstrates the constructive and prognostic validity of TCT in severely disabled patients post-CVA.
Sebastia et al., 2006	TCT and CV	FIM	The reproducibility of the CV was verified at the hospital admission, as a prognostic model for the functional condition at the hospital release (FIM). It is believed that the CV is a useful tool for decision-making regarding hemiplegic patients post-CVA.
Fujiwara et al., 2004	Fujiwara's TIS	Motor FIM	The TIS presents a prognostic functional value through the Motor FIM, which has also been confirmed for the TCT.
Verheyden et al, 2007	Verheyden's TIS	BI	The total TIS total and the TIS-SSB were the most important prognostic factors for the ADL (Barthel's index) up to six months post-CVA.

CADL - Comprehensive Activities of Daily Living; PASS-TC - Trunk Control Items of Postural Assessment Scale for Stroke Patients (PASS); BI: Barthel's index; FAI: Frenchay Activities Index; BBS- Berg Balance Scale; FIM – Functional Independence Measure; Motor FIM: motor sub-score of FIM; TCT: Trunk Control Test; FAC: Functional Ambulation Category; CV: Compound Variable (FIM + TCT), TIS: Trunk Impairment Scale; TIS-SSB: Static Body Control Scale of Verheyden's TIS.

Table 2
Description of the trunk control scales used by the authors.

Scale	Nº of Itens	Decription	Tasks	Score
T C T	4	Trunk assessment while lying, sitting and transferences	Sit up without support, roll and transfer from the lying to the sitting position.	0- does not perform 12- needs help 25- normal
PASS-TC	5	Trunk assessment while lying, sitting and transferences	Sit up without support, roll and transfer from the lying to the sitting position and vice-vers.	0 (Cannot perform)to 3 (performs without help) for all items
TIS-Fujiwara	7	Trunk assessment while lying, sitting and transferences and muscular strength assessment	Maintenance of the posture vertical; perception of the vertical posture, Straightening reflex and rotation and abdominal muscular strength.	0 (Cannot perform)to 3 (performs correctly) for all items
TIS-Verheyden	17	Evaluates the trunk in the sitting position in all planes.	Trunk control in the sitting position (supported LLLL and crossed legs); dynamic trunk control (lateral flexion, initiated at the scapular and pelvic waists) and coordination (rotation of upper and lower trunk).	Trunk control in the sitting position (3 sub-items): 0 to 7 Dynamic trunk control (10 sub-items): 0 to 10 Coordination (4 sub-items): 0 to 6
CV	4 (TCT) + 18 (MIF)	Trunk and functional activity assessment	Items TCT + Items from Motor and Cognitive FIM	$\left(\frac{\text{TCT-64}}{24.03} + \frac{\text{FIM admitance - 84.0}}{24.38}\right) * 0.561$

TCT: Trunk Control Test; PASS-TC - Trunk Control items of Postural Assessment Scale for Stroke Patients; TIS: Trunk Impairment Scale; CV: Compound Variable (FIM + TCT).

tools to evaluate trunk performance after a CVA, based on the fact that this assessment is important due to its high prognostic value. According to the authors, although several scale sub-items, such as the PASS-TC, have been described in literature and shown moderate to good reliability and some prognostic value, currently the available tests that specifically evaluate trunk performance after a CVA are the TCT and the two Trunk Impairment Scales (by Verheyden and Fujiwara).

The functional capacities, which included daily activities, gait and balance, were assessed in different ways. For the gait, the authors used parameters such as velocity, time, and level of dependence (through the Functional Ambulation Category- FAC). Balance was assessed through scales (such as Tinetti's and Berg Balance Scale) and Posturography. The daily activities included, in addition to the basic ADL, the instrumental ADL (IADL).

Verheyden's TIS was the most important prognostic factor for the basic ADL through Barthel's index (BI), with special emphasis on the TIS subscale for trunk control in the sitting position, in a group of hemiparetic patients six months after the CVA. According to the author, many of the activities assessed by the BI are performed in the sitting position, and thus, trunk control is a prerequisite for these activities.[14]

According to Hsueh[15] the ADL usually refer to the basic or personal activities, which have been largely used as the main outcome measure after the CVA. However, the basic ADL do not comprehend the significant losses at the high levels of physical functions or activities that are necessary for independence at home or in the community – the IADL. Both, the ADL and the IADL, are recommended as the primary outcome measures after the CVA and when considered together, they are called the "Comprehensive Activities of Daily Living – CADL".

Two authors confirmed the prognostic value of trunk control for the CADL up to one year, through the PASS-TC.[7,16] Several studies confirmed the impact of the motor, cognitive and perceptual sequelae on functional autonomy. Among these disabilities, the motor deficits are one of the most important ones in terms of their impact on the capacity to perform the ADL.[17]

Verheyden[8] through the TCT and TIS, and Duarte[11] through the TCT, had also observed the importance of trunk control for balance, gait and functional independence (through the Functional Independence Measure – FIM).

Nyberg et al[18] developed a predictor model of fall for patients after a CVA, which contains in one of its items, the score of postural stability that evaluates the latter through balance reactions in sitting position, as well as stability on unipodal and bipodal support. Lanzetta[19] reports that the body in the sitting position, without the trunk support, becomes unstable. When the support basis is a level surface, the trunk responds with movements to counterbalance the changes in the center of gravity. The stability of the trunk on an unstable surface depends on the capacity to align the projection of the center of mass with the center of rotation of the support basis. Additionally, the central nervous system (CNS) also needs to control the inertial forces generated by the trunk movements. Therefore, the trunk stability results from the correct perception of body movements and the development of adequate muscular responses.

Regarding gait, the authors observed that the patients that walked more than 50 m, those who performed the timed get up and go test and the ones who had a higher gait velocity at hospital release obtained the best performance in trunk control, initially.[8,11] Postural disorders are frequent in hemiparetic patients and limit or delay the recovery of gait and functional independence.[20]

In addition to the TCT, Duarte[11] used the compound variable, a combination between the TCT and the FIM, also used by Sebastia.[12] These authors, together with Franchignoni10 observed the prognostic value of the trunk for the functional capacities through the FIM, in particular the items of self-care (such as dressing oneself), mobility (such as transferences) and locomotion (stairs). Fujiwara's TIS also presented a prognostic value through the FIM.[21]

Fujiwara's TIS is the only scale found that contains items of muscular strength assessment, confirming the assertion that there are outcomes that demonstrate an association between muscular strength and trunk control.[16] Therefore, Karatas[4] agrees with the abovementioned authors by demonstrating this association, concluding that even a moderate trunk muscle weakness can lead to balance and stability alterations as well as functional disability.

The trunk muscles have an important role in body support in anti-gravitational postures, such as sitting down and orthostasis, and in the stabilization of the proximal body parts during functional limb movement. Their function is essential for a successful rehabilitation of patients after a CVA.[9]

Sèze[20] through the FIM, observed an improvement in functional independence and other capacities that were similarly assessed by other aforementioned authors, such as postural control (TCT, sitting and standing balance) and gait (through the FAC), after a specific treatment for the trunk of patients one month after the CVA. This outcome confirms the assertions on the importance of assessment and treatment of the trunk at an early stage after the CVA.[7,8]

CONCLUSION

We conclude that the clinical assessment of trunk control through the use of scales constitute an important tool for the prognosis of functional capacities of hemiparetic patients after CVA, such as ADL and gait, and for the planning of a specific and differentiated treatment for these patients. However, few studies have confirmed this association, as they used different scales and there was no consensus among the authors. In addition to the scales, there is no data concordance for the assessment of balance and gait.

In their systematic review, Verheyden et al[13] concluded that the most limiting aspect of TCT is its ceiling effect and that recent studies demonstrated this effect in PASS-TC at several stages after the CVA. Therefore, these items are little sensitive to small functional losses and cannot differentiate healthy individuals from those with mild physiological decline, and they are not difficult enough to identify high levels of functional capacity or performance. This effect was not observed in the TIS by Verheyden and was not evaluated in the TIS by Fujiwara.

We, therefore, emphasize the need for further studies to confirm

this association using more complete scales, in addition to the translation and validation of these scales in Brazil so that more reliable studies can be carried out, which will be useful for our country.

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