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Sensory evaluation tools stroke described in Portuguese: a systematic review

Instrumentos de avaliação sensorial pós-acidente vascular encefálico (AVE) descritos em português: uma revisão sistemática

Los instrumentos de evaluación sensorial posaccidente vascular encefalico (AVE) descriptos en portugués: una revisión sistemática

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ABSTRACT | Most survivors of stroke present, among other consequences, a sensory deficit. To assess the impact of this deficit on the activity and the effect of sensory reeducation protocols, it is important to use objective instruments. The objective of this systematic review was to analyze which sensory evaluation tools for post-stroke patients are available in Brazilian Portuguese and describe its features and/or properties. A search was conducted in the electronic databases SCIELO, LILACS, PUBMED, CINAHL, MEDLINE via OVDI, and EMBASE. The relevant studies were analyzed as to accessibility, objectivity of the score and measurement properties, adding articles through manual search when necessary. The search resulted in 96 studies, reduced to five eligible ones. A study was added through the list of references and the manual search was used for complementation. Among the seven reviewed articles, only three sensory evaluation tools are available in Portuguese: moving touch pressure (MTP), sensitivity domain of Fugl-Meyer Scale (FMS), and Nottingham Sensory Assessment (NSA). In addition, although the reliability of the FMS and of the NSA may be considered appropriate, the other properties of measurement need to be evaluated in future studies.

Keywords | Stroke; Sensory Modalities; Touch; Proprioception.

RESUMO | Grande parte dos sobreviventes de acidente vascular encefálico (AVE) apresenta, além de outras sequelas, algum déficit sensorial. Para avaliar o impacto desse déficit na atividade e o efeito de protocolos de reeducação sensorial é importante utilizar instrumentos objetivos. Os objetivos desta revisão sistemática foram analisar quais instrumentos de avaliação sensorial para pacientes pós-AVE estão disponíveis em português brasileiro e descrever suas características e/ou propriedades. Realizou-se uma busca nas bases de dados eletrônicas SciELO, LILACS, PubMed, CINAHL, MEDLINE via OVDI e Embase. Os estudos relevantes foram analisados quanto à acessibilidade, objetividade da pontuação e propriedades de medida, acrescentando-se artigos por meio de busca manual quando necessário. As buscas resultaram em 96 estudos, reduzidos a cinco estudos elegíveis. Um estudo foi adicionado por meio da lista de referências, e a busca manual foi utilizada para complementação. Entre os sete artigos analisados, há somente três instrumentos de avaliação sensorial disponíveis em português: Moving touch pressure (MTP), domínio sensibilidade da Escala de Fugl-Meyer (EFM) e Avaliação Sensorial de Nottingham (ASN). Além disso, embora a confiabilidade da EFM e da ASN possa ser considerada adequada, as demais propriedades de medida necessitam ser avaliadas em futuros estudos.

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Descritores | Acidente Vascular Cerebral; Modalidades Sensoriais; Tato; Propriocepção.

RESUMEN | Gran parte de los supervivientes de accidente vascular encefálico (AVE) presentan, además de otras secuelas, alguno déficit sensorial. Para evaluar el impacto de ese déficit en la actividad y el efecto de protocolos de reeducación sensorial es importante utilizar instrumentos objetivos. Los objetivos de esta revisión sistemática son analizar cuales instrumentos de evaluación sensorial para pacientes pos-AVE están disponibles en portugués brasileño y describir sus características y/o propiedades. Se realizó una búsqueda en las bases de datos electrónicos SciELO, LILACS, PubMed, CINAHL, MEDLINE vía OVDI y Embase. Los estudios relevantes fueron analizados en relación a la accesibilidad, objetividad de la puntuación y propiedades de medida, añadiéndose artículos mediante búsqueda manual cuando necesario. Las búsquedas resultaron en 96 estudios, reducidos a cinco estudios elegibles. Se agregó un estudio mediante la lista de referencias, y se utilizó la búsqueda manual para la complementación. Entre los siete artículos analizados, hay solamente tres instrumentos de evaluación sensorial disponibles en portugués: Moving touch pressure (MTP), dominio sensibilidad de la Escala de Fugl-Meyer (EFM) y Evaluación Sensorial de Nottingham (ESN). Además, aunque la confiabilidad de la EFM y de la ESN es considerada adecuada, las demás propiedades de medida necesitan ser evaluadas en estudios futuros.

Palabras clave | Accidente Vascular Cerebral; Modalidades Sensoriales; Tato; Propiocepción.

INTRODUCTION

Stroke are the leading cause of death in the adult population of Brasil[1] and one of the main reasons of disability in the world, since 70% of patients do not return to a productive life[2]. The classic sign caused by stroke is hemiplegia or hemiparesis, however most survivors present some sensorial deficit[3,4] that varies in intensity, area, and mode, and that is not well rated in routine exams[3,5].

In the acute phase after stroke, sensory changes may reach 85% of cases[5]. For Tyson et al.[4] and Wagner et al.[12], the impairment of the tactile sensitivity is more common than the proprioceptive one, while Conell, Lincoln and Radford[3] argue that proprioception and stereognosis are more often impaired. Scalha et al.[7] evaluated the sensitivity in the affected upper limb of 20 patients with hemiparesis. All showed impairment in at least one of the sensory modalities evaluated, and, respectively, only 5% and 20% of the sample presented tactile discrimination or preserved stereognosis.

Sensory function is related to the motor function[6,7], in a way that sensory deficits interfere in the performance of activities and in the rehabilitation[7]. Individuals without sensory changes present better motor recovery[8,9], better levels of activity and a reduction in the length of hospital stay[10]. However, the sensory recovery, after stroke, receives less attention than motor recovery[11].

Sensitivity is related to mobility and independence in daily life activities[4]. Deficits in ankle proprioception change the walking intensity[13,14] and interfere in the distance walked in the Six-Minute Walk Test[15].

The knowledge of sensory deficits helps choosing rehabilitation strategies[16]. A systematic review[17] found 16 sensory measuring tools, but 11 were not available for use, with few measures undertaken to provide consistent data and easy application. There is a need for standardization, and specific and reliable tests to evaluate the sensory condition of post-stroke patients[18]. It is necessary to determine the most relevant focus to recover the somatosensory functions[8] creating sensory rehabilitation protocols in different stages of recovery[19].

In this context, the objectives of this study were (1) to review systematically the standardized sensory assessment tools and with quantitative results available in Portuguese to evaluate patients affected by stroke; and (2) to describe their features and/or measurement properties.

METHODOLOGY

This systematic review followed the recommendations of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) when pertinent[20].

The search aimed to identify evaluation instruments translated and/or validated to Portuguese. Articles published until March 2013 were searched in the databases: MEDLINE via OVDI, CINAHL, PUBMED, EMBASE – keywords and operators were (sensation OR touch OR tactile alteration OR proprioception OR joint position OR joint movement) AND (scales OR measures OR instruments OR clinical assessment tools) AND (stroke OR hemiplegia

OR hemiparesis) AND (portuguese OR brazil OR brazilian); LILACS and SCIELO – (sensação OR toque OR alteração tátil OR propriocepção OR posição articular OR movimento articular) AND (escalas OR mensurações OR instrumentos OR instrumentos de avaliação clínica) AND (Acidente Vascular Encefálico OR hemiplegia OR hemiparesia) AND (português OR Brasil OR brasileiro). The titles/abstracts were checked by two researchers to select the relevant articles.

For selection, the articles were reviewed independently and blindly by two other researchers, according to the following inclusion criteria: *Characteristic* – study that evaluates sensitivity; *Participants* – adults >18 years diagnosed with stroke; *Accessibility* – form of application described in Brazilian Portuguese, available online and/or by contacting the author*; *Test* – tactile sensitivity and/or proprioceptive sensitivity and/or stereognosis; *Measure* – test that results in measure/objective outcome; *Reliability* – described in Portuguese or in the original version. *If the translation process has generated an article in English, we contacted the original authors to check the availability of the instrument and the description of the application in Portuguese. We only included the instrument in the study when their availability was identified. The exclusion criterion was the non-standardization of the test application.

Microsoft Excel® spreadsheets with the checklist of inclusion criteria of each evaluator were compared and, when there were disagreements, the final inclusion was discussed with a third author. Theses/dissertations were consulted for completion when found in manual search, which was carried out to identify the description of the test's application in Portuguese.

For data extraction, we analyzed studies based on the description of the test in Brazilian Portuguese, evaluated sensory mode, form of application, score and measurement properties[21], when described. The studies were evaluated according to the Consensus-based Standards for the selection of health Measurement Instruments (COSMIN)[22]. The COSMIN checklist follows three steps and is recommended for use in systematic reviews of measurement properties. Step one of COSMIN is the verification of which measurement properties were evaluated (Internal Consistency, Reliability, Measurement Error, Content Validity, Structural Validity Test of Hypotheses, Cross-cultural Validation, Criterion Validity and Responsiveness). Step two is to determine if the statistical method used in the article is based on the classical test theory (CTT) or on the item response theory (IRT). Step three is to determine if a study complies with the requirements of good methodological quality and constitutes in boxes of evaluation for several specific items that are classified as excellent, good, reasonable, and poor.

RESULTS

Searches resulted in 96 studies, 10 evaluated by the inclusion/exclusion criteria and the rest deleted by the reading of title/abstract or if they were duplicates. Of ten reviewed articles, five did not present the inclusion criteria and the other five described the application of three instruments for sensitivity evaluation in post-stroke individuals: Moving touch pressure[23,24], sensitivity domain of the Fugl-Meyer Scale[7,25], and Nottingham Sensory Assessment[7,19]. Of the studies above, three were published in English[7,23,24]. By manual search, we identified the full description of a test application[26] and, in the list of references, we identified another study concerning the Fugl-Meyer Scale[27] (Figure 1).

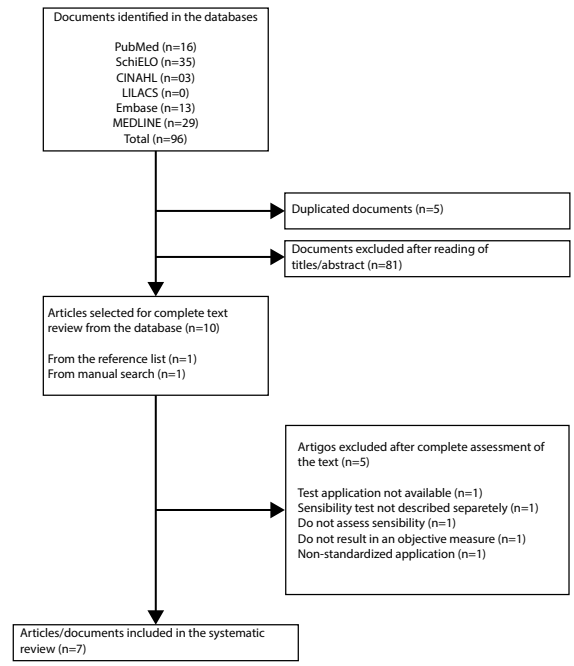

Figure 1. Flowchart of the systematic review

Two instruments were validated for the Brazilian population and had their reliability assessed showing adequate levels – domain sensitivity of the Fugl-Meyer Scale (FMS)[25,27] and Nottingham Sensory Assessment (NSA)[19].

Standardization/test description

NSA identifies sensory deficits through four subscales (Table 1). The total score for tactile sensation (light touch, pressure, pinprick, temperature, tactile location in both hemibodies, simultaneous bilateral tactile touch) ranged from 0 to 90 for the hemibody unaffected, and from 0 to 108 for the affected one; proprioception (execution of movement, direction and joint position) has a maximum of 21 points; stereognosis (recognition of 11 objects) can score from 0 to 22; discrimination between two points (index finger and thenar region) has maximum score of 4 points[19]. When it was not possible to test an item, Lima et al.[9], in the Brazilian version, used a score from 4 to 9, whereas Connell[28] gives scores from 4 to 10. The NSA was drafted in 1991, showing good intra-rater reliability and poor inter-rater reliability[29]. After reduction of items, we found acceptable levels of inter-rater reliability, but they were not good[30]. The Brazilian version[19] showed high intra- and inter-rater reliability, except for temperature, and correlation with the sensitivity of the FMS subscale.

The sensitivity of the FMS evaluates the tactile location and sense of movement. From the translation of the manual prepared by Dutil et al.[31], Michaelsen et al.[25] describe tactile sensitivity being evaluated in anterior and posterior region of the shoulder, arm, forearm, thumb, index finger, middle third of the anterior tibial region and plantar region of the foot in both hemibodies, with a maximum of 20 points for upper limb and 4 for lower limb. Sense of movement was evaluated in the shoulder, elbow, wrist, thumb, hip, knee, ankle and hallux, with total score of 8 points for upper limb and 8 for lower limb. In the study by Maki et al.[27], the exteroceptive sensitivity was evaluated in the upper limb (without specifying the stimulus location), palm of the hand, thigh and sole of the foot, with a maximum of 8 points. The inter[25,27] and intra-observer[27] sensory domain reliability of the Brazilian version of FMS was excellent.

Table 1. Characteristics of studies and instruments' description

Reference	Characteristics of the Sample	Modality	Material	Forms of Punctuation	Measurement Properties
NSA Lima et al., 2010[19]	n = 21; Age (years) 49.5±13,6; Time after the stroke (months) 40.2±32.4	Tactile sensation Proprioception Stereognosis Discrimination between two points.	Cotton; test tubes with hot or cold water and talcum powder; monofilament (green); coins of R$0.01 , 0.10 and 1.00; pen; pencil; comb; scissors; sponge; flannel; cup; glass; compass.	Tactile sensation and stereognosis: (0) missing; (1) changed; (2) normal. Discrimination between 2 points: (0) missing; (1) > 3 mm fingers and >8 mm hand; (2) < 3 mm fingers and < 8 mm hand. Proprioception: (0) missing; (1) execution of the wrong motion-direction; (2) direction of motion > 10th; (3) normal or joint position < 10th. (4) to (9) not testable.	<u>Brazilian version</u>[19]: Inter-rater reliability ICC of 0.80 to 1.00 among the items. Intra-rater reliability ICC of 0.86 to 1.00, except for temperature (ICC - 0.07).
FMS Michaelsen et al., 2011[25]	n=18; Age (years) 59±10; Time after the stroke (months) 39±33.6	Tactile sensitivity and proprioception	Cotton	Tactile sensitivity: (0) lack of sensitivity; (1) hypo- or hypersensitivity (2) normal sensitivity. Sense of movement (0) does not identify the movement; (1) at least 75% of the correct answers; (2) all the correct answers.	<u>Brazilian version:</u> Inter-rater reliability: tactile ICC 0.75; sense of movement ICC of 0.98[25] Inter-observer reliability: exteroceptive ICC 0.98-0.99; proprioceptive ICC 0.97-0.98. Inter-observer reliability: exteroceptive ICC 0.87 to 0.92; proprioceptive ICC 0.93 to 0.94[27].
Maki et al., 2006[27]	n=50; Age (years) 58 (17-81); Time after the stroke (months) 5.(13-127)				
MTP Faria-Fortini et al., 2011[24] (Faria, 2008[26])	n = 55; Age (years) 54±13; Time after the stroke (months) 64±55	Mobile discriminatory touch	Tigre Pinctore® brushes references 815/14 , 483/18, 183/14[24].	Number of correct answers in percentage: 0% indicates that there was no correct answer and 100% indicates that they were all correct.	<u>Original version</u>[18] Inter and intra-rater reliability: ICC 0.92
Brasil-Neto; Lima, 2008[23]	n=25; Age (years) 58.2±11.1; Time after the stroke (months) 43.8±55.4		Condor® brushes no. 20 of "light", "medium" and "heavy" "bristles"[23].		<u>Brazilian version:</u> Not evaluated

NSA: Nottingham Sensory Assessment; FMS: Fugl-Meyer Scale; MTP: Moving Touch Pressure; ICC: intraclass correlation coefficient

Moving Touch Pressure (MTP) measures the tactile sensitivity, by discriminating the sensation generated by 3 brushes (1 cm wide and 2.5 cm in length) of different textures, and verbal indication of which brush touched the skin. The brush is positioned at an angle of 30° with the surface of the skin, with enough force to slightly bend the bristles, and stimulus applied to two centimeters from proximal to distal in the distal phalanx's palm surface of the index finger in sliding movements[23,24,26].

Measurement properties

The studies by Brasil-Neto; Lima, 2008[23] and Faria-Fortini et al., 2011[24] were included to satisfy the first goal of this review, i.e. to describe tests available in Portuguese, which are standardized and with quantitative results. However, they did not evaluate the psychometric properties of these tests. Of the included studies, only three assessed measurement properties[19,25,27] and all used the classical theory. Of the nine items proposed by COSMIN, only reliability was evaluated in three studies. In addition to reliability, the study of Lima et al.[19] also assessed Internal Consistency with Cronbach's alpha and Criterion Validity with Pearson Correlation test.

As for their methodological quality of reliability, of the eleven items evaluated, seven showed excellent quality in all three assessed articles (Table 2). None of the studies had a sample size that reached a number of participants of at least 100 individuals to be considered excellent, according to the criteria of COSMIN. The time interval between the assessments was three days and a week, which is considered inferior than the ideally suggested by COSMIN to achieve an excellent score. Still considering the type of score used by the scales, the Kappa-related items were considered not applicable.

DISCUSSION

The description of the tools' qualities of measurement is critical to improve the quality of the research and to enable reliable data for clinical practice, because the measurement allows the quantitative comparison of the results[32]. Translation and mensuration studies of measurement properties of sensory evaluation tests are recent in Brazil. Regarding the psychometric property of reliability, studies of sensory assessment tools showed, generally, good results. Maki et al.[27] found excellent inter-observers reliability for the sensitivity of the FMS subscale when an appraiser applied the test, while the other two watched and scored. When the test was applied by two different examiners, Michaelsen et al.[25] reported excellent reliability for the tactile and proprioceptive sensitivity after adapting the manual with pictures illustrating the location for the tactile test and the position of the hands for the proprioceptive test. Using the original version of FMS[33], Sanford et al.[34] found excellent inter-rater reliability among three physical therapists applying the scale.

Table 2. Evaluation of the reliability's study design according to the COSMIN Checklist (Box B)

Reference	Lima et al., 2010[19]	Michaelsen et al., 2011[25]	Maki et al., 2006[27]
Test	NSA	FMS	FMS
Items evaluated			
Sample size	P	P	G
Two evaluation measures	E	E	E
Independent evaluation	E	E	E
Interval of described time	E	E	E
Participants' Clinical stability	E	E	E
Interval of described time	R	G	R
Conditions of the application of similar test	E	E	E
There are major flaws in the method's design	E	E	R
Was it calculated the ICC?	E	E	E
Were Kappa calculated for dichotomous/nominal or ordinal items?	NA	NA	NA
Was the weighted Kappa calculated for ordinal scores?	NA	NA	NA

E = excellent; G = good; R = reasonable; P = poor; NA = not applicable

MTP is used in Brazil[23,24], but no national study evaluated its psychometric characteristics. It was developed, described and had its measurement properties evaluated by Dannenbaum et al.[18] demonstrating significant correlation with the Semmes-Weinstein and Moberg tests, and high inter- and intra-rater reliability.

The index finger's distal sensitivity assessed through MTP was significant, along with the grip force variables, to explain the levels of activity in the upper limb[24].

The Brazilian version of the NSA showed excellent intra-rater reliability (test-retest) and inter-rater in all NSA items.

FMS' sensitivity session is restricted to the assessment of tactile location and sense of movement. NSA, in its turn, along with the tactile sensation and proprioception, also evaluates the stereognosis and the discrimination between two points[19]. While in FMS and NSA touch is evaluated statically, in the MTP it is evaluated dynamically, which can be more relevant to the function, however the application is limited in just one location of the hand. FSM offers a quick and less detailed review of the sensitivity, while the NSA offers a detailed one and the MTP offers a specific assessment for manual mobile touch.

A systematic review[17] evaluated seven scales concerning the time of application, cost, need for equipment and portability. In a score from 0 to 10, three scales achieved good score since the modified version of the NSA and sensory subscale of the FSM gained nine points and the MTP eight points.

The Semmes-Weinstein test is used in the sensory evaluation of peripheral nerve injuries[35], however the article that evaluated its measurement properties was not found. Although the search in the database has not identified any article with this test, some research already used it in patients affected by stroke[36,37].

With the exception of NSA that evaluated internal consistency and criterion validity[19], other studies showed the limitation of assessing just reliability. We highlight the importance of research that evaluate other measurement properties of these instruments. Only the presence of adequate reliability is not enough to prove that the instrument evaluates what it intends to. Sousa[38] used the NSA to report improvement in the tactile sensitivity of patients subjected to sensory stimulation of the hand. However, sensitivity to change was not assessed in any of the sensitivity assessment tools available in Portuguese. We suggest that the evaluation of these instruments' ability to detect changes is included, enabling the assessment of the sensory rehabilitation effect in this population.

Considering the measurement properties' lack of assessment of sensory evaluation tools available in Portuguese – including the properties described by COSMIN –, it was possible to analyze them considering just the methodological quality used to assess reliability, which is a limitation of this study.

CONCLUSION

This review found three sensory evaluation tools in Portuguese that clearly describe the application and present a quantitative score for sensory evaluation of post-stroke patients. Reliability was the only measurement property evaluated in two of the instruments (FMS and NSA) and we considered it adequate. We also evaluated the internal consistency and criterion validity of the NSA. However, future studies need to evaluate the other measurement properties of these instruments. Few sensory tests for the population with stroke are available in Portuguese and with insufficient evaluation of their measurement properties.

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