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Original article

The Cognitive Assessment scale for Stroke Patients (CASP) vs. MMSE and MoCA in non-aphasic hemispheric stroke patients

C. Benaim [a,b,c,*], J.L. Barnay [a], G. Wauquiez [a], H.Y. Bonnin-Koang [d], C. Anquetil [d], D. Pérennou [e,f], C. Piscicelli [e], B. Lucas-Pineau [g], L. Muja [h], E. le Stunff [h], X. de Boissezon [i,j,k], C. Terracol [i], M. Rousseaux [l], Y. Bejot [m], D. Antoine [a], C. Binquet [b], H. Devilliers [b]

[a] *Pôle de rééducation et réadaptation, CHU de Dijon, 23, rue Gaffarel, 21079 Dijon, France*
[b] *Inserm, centre d'investigation clinique, module épidémiologie clinique (CIC1432), CHU de Dijon, Dijon, France*
[c] *Inserm, U1093, Dijon, France*
[d] *Département de MPR, unité de rééducation neurologique, CHU de Nîmes, 30240 Le Grau-du-Roi, France*
[e] *Institut de rééducation, clinique MPR, hôpital sud, CHU de Grenoble, BP 338, avenue de Kimberley, 38434 Echirolles, France*
[f] *Laboratoire TimC CNRS, université Joseph-Fourier, Grenoble 1, France*
[g] *CRF COS DIVIO, 12, rue Saint-Vincent-de-Paul, 21000 Dijon, France*
[h] *Pôle de soins de suites et de réadaptation, centre hospitalier Tonnerre, chemin des Jumeriaux, 89700 Tonnerre, France*
[i] *Pole neurosciences, CHU Purpan, place du Dr-Baylac, 31059 Toulouse, France*
[j] *Inserm, imagerie cérébrale et handicaps neurologiques UMR 825, 31059 Toulouse, France*
[k] *Imagerie cérébrale et handicaps neurologiques UMR 825, université de Toulouse, CHU Purpan, place du Dr-Baylac, 31059 Toulouse, France*
[l] *Service de rééducation neurologique, hôpital Swynghedauw, CHRU de Lille, 59037 Lille, France*
[m] *Service de neurologie, CHU de Dijon, 1, boulevard Jeanne-d'Arc, 21379 Dijon, France*

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ABSTRACT

Introduction: CASP specifically assesses post-stroke cognitive impairments. Its items are visual and as such can be administered to patients with severe expressive aphasia. We have previously shown that the CASP was more suitable than the Mini Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) in aphasic patients. Our objective was to compare the above scales in non-aphasic stroke patients, and assess to what extent the solely visual items of the CASP were problematic in cases of neurovisual impairments.
Methods: Fifty non-aphasic patients admitted to Physical Medicine and Rehabilitation (PM&R) units after a recent left- or right-hemisphere stroke were evaluated with the CASP, MMSE and MoCA. We compared these three scales in terms of feasibility, concordance, and influence of neurovisual impairments on the total score.
Results: Twenty-nine men and 21 women were included (mean age 63 ± 14). For three patients, the MoCa was impossible to administer. It took significantly less time to administer the CASP (10 ± 5 min) than the MoCA (11 ± 5 min, $P = 0.02$), yet it still took more time than MMSE administration (7 ± 3 min, $P < 10^{-6}$). Neurovisual impairments affected equally the total scores of the three tests. Concordance between these scores was poor and only the CASP could specifically assess unilateral spatial neglect.
Conclusion: The sole visual format of the CASP scale seems suitable for administration in post-stroke patients.

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1. Introduction

The relevance of assessing cognitive impairments early on after stroke has been largely validated. Several batteries of tests are used in clinical practice today, regardless of having been previously validated for that specific use. In a recent work [3,4], we reported the main assessments scales for cognitive disorders and demonstrated the superiority of the Cognitive Assessment scale for Stroke

* Corresponding author at: Pôle de rééducation et réadaptation, CHU de Dijon, 23, rue Gaffarel, 21079 Dijon, France. Tel.: +33 3 80 29 33 71.
E-mail addresses: charles.benaim@chu-dijon.fr (C. Benaim), hueiyune.bonnin@chu-nimes.fr (H.Y. Bonnin-Koang), DPerennou@chugrenoble.fr (D. Pérennou), blucaspineau@cos-asso.org (B. Lucas-Pineau), L.MUJA@ch-tonnerre.fr (L. Muja), deboissezon.xavier@chu-toulouse.fr (X. de Boissezon), Marc.ROUSSEAUX@CHRU-LILLE.FR (M. Rousseaux), yannick.bejot@chu-dijon.fr (Y. Bejot).

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Patients (CASP) over the Mini Mental State Examination (MMSE) [5,6] and MoCA (Montréal Cognitive Assessment) [11] in terms of feasibility in a population of post-stroke aphasic patients. As a matter of fact, the CASP was specifically designed, both in terms of content and format, for a quick evaluation of post-stroke cognitive disorders at "the patient's bedside". Its main characteristics consist in (see details in the primary publication by Barnay et al., [4]):

- six cognitive functions being evaluated: language, praxis, short-term memory, temporal orientation, spatial neglect/visual construction, executive functions (Appendix 1);
- each of the six functions is scored on a scale of 6 (equal weight attributed to each function). The score is expressed either as a profile (i.e. "5-6-4-2-3-4"), or as a total score out of 36;
- patients can answer the tests without using language (solely visual tests or designating the right answer among distractors). The CASP can be administered to patients with mutism as long as they retained some oral comprehension for simple orders (BDAE aphasia severity score ≥ 3 for the comprehension dimension [7,10]);
- elements from the test that the patient must look at are systematically ordered in a column and/or placed on the right side of the test sheet to minimize the influence of left unilateral spatial neglect;
- it is the only short cognitive evaluation battery containing a test validated specifically for spatial neglect, issued from the French unilateral neglect battery BEN (Batterie d'Evaluation de la Négligence) (20-cm horizontal line bisection test) [2];
- shorter administration time in aphasic patients (13 ± 4 min).

In our first study we were able to note that when MMSE and MoCA could not be administered to several aphasic patients, it was however possible to administer the CASP in these patients. For other patients, results to the MMSE and MoCA tests evaluating non-language functions were highly influenced by the severity of aphasia, significantly more than for the CASP. Therefore, with the CASP we observed (in this work and in our daily clinical practice) that a significant portion of aphasic patients retained a pretty good orientation to time, an element impossible to verify with the MMSE and MoCA. However, in this study, we experienced great difficulties in administering the CASP in at least one patient presenting major neurovisual impairments (cortical blindness). This observation was expected since CASP items are solely visual-related.

Of course, CASP relevance would be quite limited if it was restricted to aphasic patients (this is why we took into account a possible left spatial neglect in designing the test). The objectives of the present study were to validate the applicability of CASP in non-aphasic stroke patients, assess the influence of neurovisual disorders on CASP administration, and compare CASP scores to those of the MMSE and MoCA.

2. Patients and methods

During 2013, we recruited fifty patients consecutively admitted in seven PM&R units for recent primary hemispheric stroke without aphasia. They all benefited from the systematic administration of the CASP, MMSE and MoCA. The study consisted in:

- estimating the percentage of patients for whom the administration of one or several items of these three scales was impossible;
- comparing the mean administration time of the tests;
- evaluating in each battery of tests the influence of neurovisual impairments on the total score (outside of neurovisual items);
- comparing the scores of the three batteries.

2.1. Inclusion criteria

Patients hospitalized in a rehabilitation unit during the first 100 days following a primary stroke affecting the left and/or right hemisphere, not presenting with aphasia, without any restriction in terms of age or severity of cognitive disorders.

2.2. Exclusion criteria

Consciousness disorders, patients not speaking French, cognitive, psychotic or visual disorders, not compatible with reading, which were known prior to the stroke, stroke-induced language impairments (BDAE aphasia severity score between 0 and 5).

2.3. Administration of the three tests

According to the local context, the tests could be administered by a physician, a resident, a speech therapist, or a neuropsychologist. The order in which the three tests were administered was decided in advance by random drawing. For each patient, one unique examiner had to administer the three tests.

2.4. Collected data

Scores and administration times of the three scales were noted. Scores for items exploring neurovisual functions were calculated separately for each scale: sum of item 3 (copy of a cube) and item 6 (line bisection), on 6 points for the CASP; item 6 (reproduction of a drawing), on 1 point for the MMSE; item 1 (drawing letters/numbers to connect + reproducing a cube + watch test), on 5 points for the MoCA. General demographic data and stroke characteristics were collected.

2.5. Data treatment

The comparison of mean administration times between the three batteries was evaluated by the non-parametric Wilcoxon signed-rank test (assumptions and conditions for the paired two-sample t-test were not satisfied). The influence of the neurovisual items on the total scores (outside of neurovisual items) was assessed with the Pearson product-moment correlation coefficient (for correlation) and the intraclass correlation coefficient (ICC) (for concordance). In order to evaluate how the line bisection test (CASP6) yielded specific information, a Principal component analysis (PCA) was conducted using all neurovisual tests from the three batteries. All statistics computations were conducted with the Number Cruncher Statistical System 9 software [8].

3. Results

The fifty patients planned for the protocol were included over a 4-month period (29 men/21 women). Mean age 63 ± 14 years (Ranges: 30–88), 44 were right-handed (88%), 4 were left-handed (8%), and 2 were ambidextrous (4%). Brain damage concerned the right hemisphere for 37 patients (74%), there was never bilateral damage, the stroke was ischemic for 38 patients (76%), hemorrhagic for 11 patients (22%), ischemic and hemorrhagic in 1 case (2%). Time since stroke was 40 ± 17 days (Ranges: 13–99).

3.1. Administration of the three batteries

The results of the administration of the three batteries are listed in Table 1. Three patients were unable to pass the first item of the MoCA ("visuospatial/executive" item). Among these three patients, none obtained the maximum scores on the neurovisual tests of the other two batteries. One of them was among the

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