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Brazilian version of the Frontal Assessment Battery (FAB)

Preliminary data on administration to healthy elderly

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Abstract – The Frontal Assessment Battery (FAB) has been proposed as a diagnostic tool for patients with frontal lobe syndrome. ***Objectives:*** To present the Brazilian version of the FAB and to show preliminary data on the performance of healthy elderly in the battery, correlating with age, education and scores in the Mini-Mental State Examination (MMSE). ***Methods:*** Forty-eight healthy elderly individuals (34 female/14 male) were evaluated, aged 69.3±6.1 years and with educational level=8.0±5.6 years. The subjects were submitted to the MMSE, the Cornell depression scale and the FAB, in which scores were determined for each item and for the total scale. All individuals had to attain above education adjusted cut-off scores in the MMSE and ≤7 points on the Cornell depression scale. Correlations were calculated between FAB total scores and age, educational level and MMSE scores, as well as between FAB items and education. ***Results:*** The mean score ±SD in the FAB was 13.0±2.3 (7 to 18). Total FAB scores correlated significantly with education (r=0.37; p=0.01) and MMSE scores (r=0.46; p=0.001). No correlation emerged between FAB scores and age. The mean score ±SD of the MMSE was 27.4 ± 1.8. Considering the six FAB items separately, two of them (similarities and conflicting instructions) correlated significantly with educational. ***Conclusions:*** In this group of healthy elderly, the Brazilian version of the FAB proved to be influenced by education, but not age.

Key words: frontal lobe, prefrontal cortex, aging, education, neuropsychological tests.

Versão brasileira da bateria de avaliação frontal

Resumo – A Bateria de Avaliação Frontal (BAF) foi proposta recentemente como instrumento diagnóstico para pacientes com síndrome frontal. ***Objetivos:*** Apresentar a versão brasileira da BAF e dados preliminares do desempenho de idosos saudáveis na bateria, e sua correlação com a idade, nível educacional e escores no Mini-Exame do Estado Mental (MEEM). ***Métodos:*** Foram avaliados 48 idosos saudáveis (34 mulheres/14 homens), com idade média=69,3±6,1 anos e escolaridade média=8,0±5,6 anos. Todos foram submetidos ao MEEM, à escala de Depressão de Cornell e à BAF, com escores determinados para cada item e no total. Os participantes apresentaram desempenho acima de valores ajustados para a escolaridade no MEEM e ≤7 pontos na escala de Depressão de Cornell. Foram calculadas correlações entre o escore total da BAF e as variáveis idade, escolaridade e escore do MEEM, como também a correlação entre os itens da BAF e a escolaridade. ***Resultados:*** O escore médio ±DP na BAF foi 13,0±2,3 (7-18). Os escores totais da BAF se correlacionaram significativamente com a escolaridade (r=0,37; p=0,01) e com os escores do MEEM (r=0,46; p=0,001). Não foi observada correlação entre a BAF e a idade. O escore médio do MEEM foi 27,4 ± 1,8. A análise separada dos itens da BAF mostrou que dois deles (similaridades e instruções conflitantes) se correlacionaram significativamente com a escolaridade. ***Conclusões:*** Neste grupo de idosos saudáveis, a versão brasileira da BAF demonstrou ser influenciada pela escolaridade, mas não pela idade.

Palavras-chave: lobo frontal, córtex pré-frontal, envelhecimento, educação, testes neuropsicológicos.

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Executive functions are mental processes involved in the realization of goal-directed behavior whether expressed through a mental or a motor act. They are thought to control formulation, planning, carrying out and effective performance of goal-oriented actions[1]. Executive functions are frequently impaired after frontal lobe or basal ganglia damage. In general, evaluation of executive functions is performed with time-consuming neuropsychological tests.

The Frontal Assessment Battery (FAB) has been proposed recently as a brief diagnostic tool to be used in cases of disexecutive syndrome[2]. It can be performed in approximately ten minutes. The FAB has been used in several groups of patients, such as Alzheimer's disease3,4, frontotemporal dementia[3,4], Parkinson's disease[5], atypical parkinsonian syndromes[6] and vascular focal lesions7. The aim of the present study was to evaluate the performance of normal elderly on the FAB, and correlate to age, schooling and score in the Mini-Mental State Examination (MMSE).

Methods

Individuals were caregivers of demented patients evaluated at the Behavioral and Cognitive Neurology Unit of the Faculty of Medicine of Federal University of Minas Gerais and volunteers recruited from the community.

The inclusion criteria were absence of neurological or psychiatric diseases, absence of depression and no use of benzodiazepines, antidepressants or neuroleptics.

A total of 48 cognitively intact elderly individuals (34 female and 14 male), aged 60 to 91 years (mean±SD= 69.3±6.1), and with educational level ranging from 1 to 20 years (mean±SD=8.0±5.6), were evaluated.

All participants were submitted to the Mini-Mental State-Examination (MMSE), to the Cornell scale of depression and to the FAB, in which scores were determined for each item and for the total scale. Performance in the MMSE adjusted to the educational level, had to be greater than or equal to 21 for 1-3 years of schooling, greater than or equal to 24 for 4-7 years and greater than or equal to 26 for individuals with 8 or more years of schooling[8]. Score on the Cornell scale of depression had to be less than or equal to 7 points in order to rule out depression[9].

The FAB consists of six subtests:

1. Similarities – Abstract reasoning is frequently impaired in subjects with frontal lobe lesions[10,11]. Such individuals present difficulties conceptualizing and finding the link between two objects belonging to the same semantic category (e.g. pear and peach)[12].

2. Lexical fluency (letter S) – Cognitive flexibility is a broad term used to refer to a person's ability to switch from one topic to another. To perform this task subjects are required to inhibit one behavior and commence another[13]. Frontal lobe damage, regardless of side, is associated to reduction of verbal fluency[14-17].

3. Motor series – To perform a sequence of gestures individuals have to organize, to maintain and to execute successive actions. This task may be impaired in patients with frontal lobe lesions[18-20].

4. Conflicting instructions – In this kind of task, as seen in the Stroop test, individuals have to inhibit prepotent stimulus and select the appropriate one[21,22]. Normal subjects are able to follow the examiner's command and not to do what they see. Subjects with frontal lobe lesions are not able to obey verbal command and tend to imitate the examiner's gestures[23].

5. Go / No-Go – This task requires the subject to make a response to a go signal and withhold the response to no-go signal[24]. Subjects with orbitofrontal lesions are impaired in this kind of task[25-27].

6. Prehension behavior – Grasping reflexes are elicited by applying pressure to the palm of the hand[28]. Patients with frontal lobe lesions may present a lack of internal control and are dependent on environmental stimuli[29]. They are sensitive to sensory stimulus and are unable to inhibit the behavior of taking the examiner's hands[30,31].

The maximum score for each subtest is 3 points and the total score of test is calculated by adding the scores of the six subtests (maximum score=18).

The FAB was translated from English into Portuguese following a thorough methodology[32]. Initially, translation of the instrument was performed by two independent translators. These two translations were then compared and an initial version in Portuguese was produced. Subsequently, back-translation into English was performed, also by two translators, in order to identify possible discrepancies in the English to Portuguese translation. Minor differences were identified and were discussed by a small panel of specialists. A final consensual Portuguese version was produced and used in the present study. The Brazilian version of the FAB is presented in Appendix.

The total scores of the FAB correlated to the scores of the MMSE, to age and to educational level. In addition, each of the six subtests also correlated to educational level. The normality of the distribution of the total FAB scores was ascertained through the Kolmogorov-Smirnov test. Pearson correlation coefficients were calculated between the different variables of interest. Statistical significance was defined as p values <0.05. Statistical analysis was performed using the MedCalc software.

The study was approved by the Research Ethics Committee of the Federal University of Minas Gerais and all participants signed the approved written informed consent.

Results

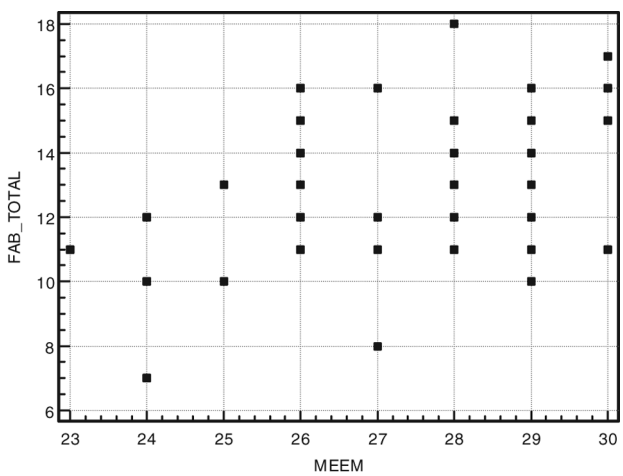
The mean total score ±SD of the FAB was 13.0±2.3, ranging from 7 to 18. The mean score ±SD of the MMSE was 27.4±1.8. Total FAB scores correlated significantly with educational level and with scores of the MMSE. No correlation was found between total scores of FAB and age. A separate analysis of each subtest of the FAB showed that only the subtests "Similarities" and "Conflicting Instructions" significantly correlated with educational level. The performance on the FAB and its correlation with the MMSE and educational level are presented in Graphs 1 and 2. Complete results of the statistical analysis are presented in Table 1. Administration of the FAB took less than 10 minutes.

Discussion

In the present study the FAB was administered to a group of elderly subjects, with no signs of cognitive impairment or depression. The FAB proved to be an easy test to administer, taking less than 10 minutes in the study sample.

Performance on the FAB, as expected, was influenced by educational level, as shown by the significant correlations found between total FAB scores and years of formal education. In addition, two subtests of the battery ("Similarities" and "Conflicting Instructions") also correlated significantly with education. According to previous arti-

Graph 1. Correlation between FAB total score and MMSE.



Graph 2. Correlation between FAB total score and education.

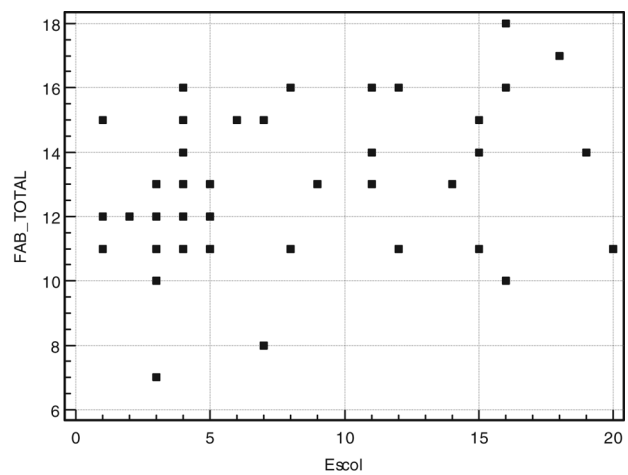


Table 1. Summary of correlations found for the FAB.

Correlations	r	p
Total score X MMSE	**0.458**	**0.001**
Total score x Age	0.102	0.490
Total score X Education	**0.366**	**0.011**
Similarities x Education	**0.332**	**0.021**
Lexical fluency x Education	0.242	0.098
Motor programming x Education	0.128	0.385
Conflicting instructions x Education	**0.287**	**0.048**
Go / No-go x Education	0.201	0.170
Prehension behavior x Education	0.000	1.0

cles, the item "Similarities" is largely influenced by education[33,34]. Similarly, the item "Conflicting Instructions", which evaluates inhibition, is also influenced by educational level[35,36]. Surprisingly, no significant correlation was observed between the subtest "Lexical Fluency" and schooling, although there was a trend towards statistical significance (p=0.0979). It is well recognized that performance in verbal fluency tasks is heavily influenced by education[37,38]. Therefore, it is likely that the examination of a larger sample of individuals might reveal a similar feature in the letter fluency task of the FAB. This work is currently ongoing in our unit.

In a previous study we have observed an association between the performance of the subtest "Motor Programming" (or the Fist-Edge-Palm task of Luria) and education[39]. However, the same relationship has not occurred in the present study, which may reflect the larger number of individuals evaluated in the previous investigation as well as the inclusion of illiterates, most of whom had great difficulties performing the task.

We have found a significant association between the performance on the FAB and on the MMSE, in contrast to results reported by Dubois et al.[2]. These results are somewhat unexpected, since the MMSE does not formally evaluate executive functions. A possible explanation for this finding is an interaction between education and the performance in the MMSE, with the former being associated with the FAB. Indeed, there was a highly significant correlation between MMSE scores and educational level (r=0.601, p<0.0001; data nor shown). Nonetheless, further studies will help to confirm this hypothesis.

In conclusion, the Brazilian version of the FAB was well understood by cognitively healthy elderly and may be a feasible instrument for brief assessment of executive functions in the clinical setting. Additional work is currently being undertaken in our unit, with a larger sample of controls and also including patients with dementia, in order to determine the diagnostic accuracy of the FAB in our milieu and also to determine cut-off scores as a function of educational level.

References

1. Lezak MD. Executive functions and motor performance. In: Lezak MD, Howieson DB, Loring DW, editors. Neuropsychological Assessment. 4th ed. New York: Oxford University Press; 2004:611-646.
2. Dubois B, Slachevsky A, Litvan I, Pillon B. The FAB: A Frontal Assessment Battery at bedside. Neurology 2000;55: 1621-1626.
3. Slachevsky A, Villalpando JM, Sarazin M, Hahn-Barma V, Pillon B, Dubois B. Frontal assessment battery and differential diagnosis of frontotemporal dementia and Alzheimer disease. Arch Neurol 2004;61:1104-1107.
4. Castiglioni S, Pelati O, Zuffi M, et al. The Frontal Assessment Battery Does Not Differentiate Frontotemporal Dementia from Alzheimer's Disease. Dement Geriatr Cogn Disord 2006;22:125-131.
5. Matsui H, Udaka F, Miyoshi T, et al. Frontal assessment battery and brain perfusion image in Parkinson's disease. J Geriatr Psychiatry Neurol 2006;19:41-45.
6. Paviour DC, Winterburn D, Simmonds S, et al. Can the frontal assessment battery (FAB) differentiate bradykinetic rigid syndromes? Relation of the FAB to formal neuropsychological testing. Neurocase 2005;11:274-282.
7. Mok VC, Wong A, Yim P et al. The validity and reliability of chinese frontal assessment battery in evaluating executive dysfunction among Chinese patients with small subcortical infarct. Alzheimer Dis Assoc Disord 2004;18:68-74.
8. Nitrini R, Caramelli P. Demências. In Nitrini R, Bacheschi LA, editors. A neurologia que todo médico deve saber. 2ª ed. São Paulo: Atheneu; 2003:323-334.
9. Alexopoulos GS, Abrams RC, Young RC, Shamoian CA. Use of the Cornell scale in nondemented patients. J Am Geriatr Soc 1988;36:230-236.
10. Reverberi C, D'Agostini S, Skrap M, Shallice T. Generation and recognition of abstract rules in different frontal lobe subgroups. Neuropsychologia 2005;43:1924-1937.
11. Green AE, Fugelsang JA, Kraemer DJ, Shamosh NA, Dunbar KN. Frontopolar cortex mediates abstract integration in analogy. Brain Res 2006;1096:125-137.
12. Lhermitte F, Derouesné J, Signoret JL. Neuropsychological analysis of the frontal syndrome. Rev Neurol (Paris) 1972; 127: 415-440.
13. Andrewes D. Executive dysfunction. In: Andrewes D, editor. Neuropsychology – from theory to practice. New York: Psychology Press, 2001:85-137.
14. Benton A. Differential behavior effects in frontal lobe disease. Neuropsychologia 1968;6:53-60.
15. Stuss DT, Alexander MP, Hamer L, et al. The effects of focal anterior and posterior brain lesions on verbal fluency. J Int Neuropsychol Soc 1998; 4:265-278.
16. Baldo JV, Shimamura AP. Letter and category fluency in patients with frontal lobe lesions. Neuropsychology 1998;12: 259-267.
17. Henry JD, Crawford JR. A meta-analytic review of verbal fluency performance following focal cortical lesions. Neuropsychology 2004;18:284-295.
18. Luria AR. Investigating of Motor Functions. In: Luria AR, editor. Higher Cortical Functions in Man. 2nd Edition. New York: Basic Books Publishers; 1980:414-435.

19. Truelle JL, Le Gall D, Joseph PA, et al. Movement disturbances following frontal lobe lesions. Neuropsychiatry Neuropsychol Behav Neurol 1995;8:14-19.
20. Rousseaux M, Godefroy O, Cabaret M, Bernati T. Dysexecutive syndrome and disorders of motor control in prefrontal mediobasal and cingulate lesions. Rev Neurol (Paris) 1996;152:517-527.
21. Demakis GJ. Frontal lobe damage and tests of executive processing: a meta-analysis of the category test, stroop test, and trail-making test. J Clin Exp Neuropsychol 2004;26:441-450.
22. Alvarez JA, Emory E. Executive function and the frontal lobes: a meta-analytic review. Neuropsychol Rev 2006;16:17-42.
23. Stuss DT, Benson DF. The frontal lobes. New York: Raven Press; 1986.
24. Malloy PF, Richardson ED. Assessment of frontal lobe functions. In: Salloway SP, Malloy PF, Duffy JD, editors. The frontal lobes and neuropsychiatric illness. Washington: American Psychiatric Publishing; 2001:125-137.
25. Rolls ET, Hornak J, Wade D, McGraph J. Emotion-related learning in patients with social and emotional changes associated with frontal lobe damage. J Neurol Neurosurg Psychiatry 1994;57:1518-1524.
26. Godefroy O, Lhullier C, Rousseaux M. Non-spatial attention disorders in patients with frontal or posterior brain damage. Brain 1996;119:191-202.
27. Picton TW, Stuss DT, Alexander MP, Shallice T, Binns MA, Gillingham S. Effects of focal frontal lesions on response inhibition. Cereb Cortex (in press).
28. Schott JM, Rosor MN. The grasp and other primitive reflexes. J Neurol Neurosurg Psychiatry 2003;74:558-560.
29. Lhermitte F, Pillon B, Serdaru M. Human autonomy and the frontal lobes. Imitation and utilization behavior: a neuropsychological study of 75 patients. Ann Neurol 1986;19: 326-334.
30. De Renzi E, Barbieri C. The incidence of the grasp reflex following hemispheric lesion and its relation to frontal damage. Brain 1992;115:293-313.
31. Etcharry-Bouyx F, Le Gall D, Allain P, Mercier P, Aubin G, Emile J. Incidence of grasping and its relationship to cerebral lesions. Rev Neurol (Paris) 2000;156: 977-983.
32. Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. J Clin Epidemiol 1993;46: 1417-1432.
33. Kaufman AS, McLean JE, Reynolds CR. Sex, race, residence, region, and education differences on the 11 WAIS-R subtests. J Clin Psychol 1988;44:231-248.
34. Malec JF, IvniK RJ, Smith GE et al. Mayo`s older American normative studies; utility of corrections for age and education for the WAIS-R. Clin Neuropsychol 1992;6(Suppl): 31-47.
35. Anstey KJ, Matters B, Brown AK, Lord SR. Normative data on neuropsychological tests for very old adults living in retirement villages and hostels. Clin Neuropsychol 2000; 14:309-17.
36. Van der Elst W, Van Boxtel MP, Van Breukelen GJ, Jolles J. The Stroop color-word test: influence of age, sex, and education; and normative data for a large sample across the adult age range. Assessment 2006;13:62-79.
37. Brucki SM, Rocha MS. Category fluency test: effects of age, gender and education on total scores, clustering and switching in Brazilian Portuguese-speaking subjects. Braz J Med Biol Res 2004;37:1771-1777.
38. Caramelli P, Carthery-Goulart MT, Porto CS, Charchat-Fichman H, Nitrini R. Category fluency as screening test for Alzheimer disease in illiterate and literate patients. Alzheimer Dis Assoc Disord (in press).
39. Nitrini R, Caramelli P, Herrera Jr. E, Charchat-Fichman H, Porto CS. Performance in Luria's fist-edge-palm test according to educational level. Cogn Behav Neurol 2005;18:211-214.

Appendix. Frontal Assessment Battery (Brazilian version; Bateria de Avaliação Frontal – FAB).

1. Similaridades (conceituação)

"De que maneira eles são parecidos?"

"Uma banana e uma laranja".

(Caso ocorra falha total: "eles não são parecidos" ou falha parcial: "ambas têm casca", ajude o paciente dizendo: "tanto a banana quanto a laranja são..."; mas credite 0 para o item; não ajude o paciente nos dois itens seguintes).

"Uma mesa e uma cadeira".

"Uma tulipa, uma rosa e uma margarida".

Escore (apenas respostas de categorias [frutas, móveis, flores] são consideradas corretas).

– Três corretas: 3
– Duas corretas: 2
– Uma correta: 1
– Nenhuma correta: 0

2. Fluência lexical (flexibilidade mental)

"Diga quantas palavras você puder começando com a letra 'S', qualquer palavra exceto sobrenomes ou nomes próprios".

Se o paciente não responder durante os primeiros 5 segundos, diga: "por exemplo, sapo". Se o paciente fizer uma pausa de 10 segundos, estimule-o dizendo: "qualquer palavra começando com a letra 'S'". O tempo permitido é de 60 segundos.

Escore (repetições ou variações de palavras [sapato, sapateiro], sobrenomes ou nomes próprios não são contados como respostas corretas).

– Mais do que nove palavras: 3
– Seis a nove palavras: 2
– Três a cinco palavras: 1
– Menos de três palavras: 0

3. Série motora (programação)

"Olhe cuidadosamente para o que eu estou fazendo".

O examinador, sentado em frente ao paciente, realiza sozinho, três vezes, com sua mão esquerda a série de Luria "punho-borda-palma".

"Agora, com sua mão direita faça a mesma série, primeiro comigo, depois sozinho".

O examinador realiza a série três vezes com o paciente, então diz a ele/ela: "Agora, faça sozinho".

Escore

– Paciente realiza seis séries consecutivas corretas sozinho: 3
– Paciente realiza pelo menos três séries consecutivas corretas sozinho: 2
– Paciente fracassa sozinho, mas realiza três séries consecutivas corretas com o examinador: 1
– Paciente não consegue realizar três séries consecutivas corretas mesmo com o examinador: 0

4. Instruções conflitantes (sensibilidade a interferência)

"Bata duas vezes quando eu bater uma vez".

Para ter certeza de que o paciente entendeu a instrução, uma série de três tentativas é executada: 1-1-1.

"Bata uma vez quando eu bater duas vezes".

Para ter certeza de que o paciente entendeu a instrução, uma série de três tentativas é executada:

2-2-2.

O examinador executa a seguinte série: 1-1-2-1-2-2-2-1-1-2.

Escore

– Nenhum erro: 3
– Um ou dois erros: 2
– Mais de dois erros: 1
– Paciente bate como o examinador pelo menos quatro vezes consecutivas: 0

5. Vai-não vai (controle inibitório)

"Bata uma vez quando eu bater uma vez"

Para ter certeza de que o paciente entendeu a instrução, uma série de três tentativas é executada: 1-1-1.

"Não bata quando eu bater duas vezes".

Para ter certeza de que o paciente entendeu a instrução, uma série de três tentativas é executada: 2-2-2.

O examinador executa a seguinte série: 1-1-2-1-2-2-2-1-1-2.

Escore

– Nenhum erro: 3
– Um ou dois erros: 2
– Mais de dois erros: 1
– Paciente bate como o examinador pelo menos quatro vezes consecutivas: 0

6. Comportamento de preensão (autonomia ambiental)

"Não pegue minhas mãos"

O examinador está sentado em frente ao paciente. Coloca as mãos do paciente, com as palmas para cima, sobre os joelhos dele/dela. Sem dizer nada ou olhar para o paciente, o examinador coloca suas mãos perto das mãos do paciente e toca as palmas de ambas as mãos do paciente, para ver se ele/ela pega-as espontaneamente. Se o paciente pegar as mãos, o examinador tentará novamente após pedir a ele/ela: "Agora, não pegue minhas mãos".

Escore

– Paciente não pega as mãos do examinador: 3
– Paciente hesita e pergunta o que ele/ela deve fazer: 2
– Paciente pega as mãos sem hesitação: 1
– Paciente pega as mãos do examinador mesmo depois de ter sido avisado para não fazer isso: 0

Appendix. Frontal Assessment Battery (FAB).

1. Similarities (conceptualization)

"In what way are they alike?"

A banana and an orange (In the event of total failure: "they are not alike" or partial failure: "both have peel," help the patient by saying: "both a banana and an orange are..."; but credit 0 for the item; do not help the patient for the two following items)

A table and a chair

A tulip, a rose and a daisy

Score (only category responses [fruits, furniture, flowers] are considered correct)

– Three correct: 3
– Two correct: 2
– One correct: 1
– None correct: 0

2. Lexical fluency (mental flexibility)

"Say as many words as you can beginning with the letter 'S,' any words except surnames or proper nouns."

If the patient gives no response during the first 5 seconds, say: "for instance, snake." If the patient pauses 10 seconds, stimulate him by saying: "any word beginning with the letter 'S.' The time allowed is 60 seconds.

Score (word repetitions or variations [shoe, shoemaker], surnames, or proper nouns are not counted as correct responses)

– More than nine words: 3
– Six to nine words: 2
– Three to five words: 1
– Less than three words: 0

3. Motor series (programming)

"Look carefully at what I'm doing."

The examiner, seated in front of the patient, performs alone three times with his left hand the series of Luria "fist–edge–palm." "Now, with your right hand do the same series, first with me, then alone." The examiner performs the series three times with the patient, then says to him/her: "Now, do it on your own."

Score

– Patient performs six correct consecutive series alone: 3
– Patient performs at least three correct consecutive series alone: 2
– Patient fails alone, but performs three correct consecutive series with the examiner: 1
– Patient cannot perform three correct consecutive series even with the examiner: 0

4. Conflicting instructions (sensitivity to interference)

"Tap twice when I tap once."

To be sure that the patient has understood the instruction, a series of three trials is run: 1-1-1. "Tap once when I tap twice." To be sure that the patient has understood the instruction, a series of three trials is run: 2-2-2. The examiner performs the following series: 1-1-2-1-2-2-2-1-1-2.

Score

– No error: 3
– One or two errors: 2
– More than two errors: 1
– Patient taps like the examiner at least four consecutive times: 0

5. Go–No Go (inhibitory control)

"Tap once when I tap once."

To be sure that the patient has understood the instruction, a series of three trials is run: 1-1-1. "Do not tap when I tap twice." To be sure that the patient has understood the instruction, a series of three trials is run: 2-2-2. The examiner performs the following series: 1-1-2-1-2-2-2-1-1-2.

Score

– No error: 3
– One or two errors: 2
– More than two errors: 1
– Patient taps like the examiner at least four consecutive times: 0

6. Prehension behavior (environmental autonomy)

"Do not take my hands."

The examiner is seated in front of the patient. Place the patient's hands palm up on his/her knees. Without saying anything or looking at the patient, the examiner brings his/her hands close to the patient's hands and touches the palms of both the patient's hands, to see if he/she will spontaneously take them. If the patient takes the hands, the examiner will try again after asking him/her: "Now, do not take my hands."