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Comparison of the MoCA and BEARNI tests for detection of cognitive impairment in in-patients with alcohol use disorders

Stéphanie Pelletier[a,b], Régis Alarcon[a], Valérie Ewert[a], Margot Forest[a], Bertrand Nalpas[a,c,*], Pascal Perney[a,c]

[a] Service Addictologie, Hôpital du Grau du Roi, CHU Caremeau, Place du Pr R. Debré, 30029 Nîmes, France
[b] Inserm U1018, Hôpital Paul Brousse, 16 avenue Paul Vaillant-Couturier, 94807 Villejuif, France
[c] Département d'Information Scientifique et de Communication, Inserm, 101 rue de Tolbiac, 75013 Paris, France

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ABSTRACT

Introduction: Screening of cognitive impairment is a major challenge in alcoholics seeking treatment, since cognitive dysfunction may impair the overall efficacy of rehabilitation programs and consequently increase relapse rate. We compared the performance of two screening tools: the MoCA (Montreal Cognitive Assessment), which is widely used in patients with neurological diseases and already used in patients with alcohol use disorder (AUD), and the BEARNI (Brief Evaluation of Alcohol-Related Neuropsychological Impairments), a recent test specifically developed for the alcoholic population.

Methods: We compared the sensitivity and specificity of the MoCA and the BEARNI in a sample of AUD patients with and without cognitive impairment assessed by a battery of neuropsychological tests.

Results: Ninety patients were included. There were 67 men and 23 women aged 48.9 ± 9.6 years. According to the neuropsychological tests, 51.1% of patients had no cognitive impairment, while it was mild or moderate to severe in 31.1 and 17.8%, respectively. The BEARNI sensitivity was extremely high (1.0), since all patients with cognitive impairment were identified, but its specificity was very low (0.04). The MoCA had a lower sensitivity (0.79) than the BEARNI, but its specificity was significantly better (0.65). A detailed analysis of the BEARNI scores showed a discrepancy between the qualitative and quantitative interpretation of the test which could, at least in part, explain its low specificity.

Conclusion: Both the MoCA and the BEARNI are screening tools which identified alcoholic patients with cognitive impairment. However, in routine use, the MoCA appeared to be more appropriate given the low specificity of the BEARNI.

1. Introduction

Alcohol use disorders (AUD) are associated with many somatic complications, particularly neurological complications. Among the complications of the central and peripheral nervous system, the highest prevalence corresponds to cognitive dysfunction. Indeed, cognitive disorders are present in more than half of the patients with an AUD (Alarcon et al., 2015; Pelletier et al., 2016; Ritz et al., 2015) even in the absence of associated neurological impairment. Identifying cognitive deficits is clinically relevant for several reasons. Firstly, some might evolve into severe forms, particularly Korsakoff disease, from which recovery is very limited. Secondly, identification of cognitive deficits also makes it possible to recognize those patients who are less likely to adhere to treatment. It has been demonstrated that patients who are cognitively impaired remember less relevant information concerning their treatment (Becker and Jaffe, 1984; Sanchez-Craig and Walker, 1982; Teichner et al., 2002) and learn fewer drink-refusal skills (Smith and McCrady, 1991). Some authors reported that cognitive disorders are associated with a higher relapse rate (Noël et al., 2001, 2002), although these results remain controversial. Noël et al. (2002) reported that alcoholic relapse at 2 months was associated with inhibition and working memory deficits as well as reduced cerebral blood flow in the bilateral medial frontal gyrus. For Sorg et al. (2012), alcohol use disorder patients who resume heavy drinking after achieving abstinence had significantly lower frontal white matter integrity in different regions associated with decision-making, impulse control, and executive functioning. Finally, neurocognitive impulsivity impacts treatment completion and appears sensitive for predicting relapse and dropout in

* Corresponding author at: Service Addictologie, Hôpital du Grau du Roi, CHU Caremeau, Place du Pr R. Debré, 30029 Nîmes, France.
E-mail addresses: stephanie.pelletier@chu-nimes.fr (S. Pelletier), regis.alarcon@chu-nimes.fr (R. Alarcon), valerie.ewert@chu-nimes.fr (V. Ewert), mforest@orange.fr (M. Forest), bertrand.nalpas@inserm.fr (B. Nalpas), pascal.perney@chu-nimes.fr (P. Perney).

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alcoholic-dependent patients (Rupp et al., 2016).

Screening for cognitive deficit in AUD patients is thus justified in alcohol treatment units, since it might help to tailor therapeutic programs. For this purpose, a simple, rapid screening test with good sensitivity, specificity, and reproducibility is needed. Currently, one of the most used tests is the MoCA (Montréal Cognitive Assessment). As proposed by Nasreddine et al. (2005) for detecting mild cognitive impairment in adults, the MoCA explores eight cognitive domains: visuospatial/executive; naming; memory; attention; language; abstraction; delayed recall; orientation. The MoCA test is widely used in Parkinson's disease (Dalrymple-Alford et al., 2010; Fengler et al., 2016), several cardiac diseases (Ball et al., 2013; Cameron et al., 2013), as well as mild strokes and ischemic attacks (Zuo et al., 2016). In AUD patients, MoCA has been reported to allow rapid and confident screening of cognitive deficits (Alarcon et al., 2015; Copersino et al., 2009) but also to evaluate the change in cognition status following alcohol withdrawal (Likhitsathian et al., 2013; Pelletier et al., 2016).

A new screening tool of cognitive impairment specifically devoted to AUD patients, the BEARNI (Brief Evaluation of Alcohol-Related Neuropsychological Impairments) score, was recently developed (Ritz et al., 2015). It explores five cognitive and motor functions that are impaired in AUD: episodic memory, working memory, executive functions, visuospatial abilities, and ataxia.

As it is specifically developed for AUD patients, the BEARNI may well either complete or even replace the MoCA for evaluating cognitive impairment in alcoholic subjects. In order to determine how these tests should be used, we compared their respective screening performance in a large sample of AUD patients whose cognitive status was assessed using a battery of neuropsychological tests.

2. Patients and methods

2.1. Patients

The study was conducted in the rehabilitation center for patients dependent on any psychoactive drug located in the teaching hospital of Nîmes (France) and approved by the local ethics committee. Patients admitted for AUD from January to June 2017 were prospectively considered for eligibility. Inclusion criteria were oral agreement to participate, age above 18 years, ability to understand and speak French, and dependence on alcohol assessed by the DSM IV. Exclusion criteria were severe co-morbid neurological or psychiatric diseases such as dementia, Alzheimer's disease, psychosis, past history of stroke, coma, or encephalopathy, current consumption of cocaine and/or cannabis and/or heroin before admission, and refusal.

We recorded the following sociodemographic data: age, sex, marital status (single/in a relationship), education level (equal to or higher than 12 years), family history of alcohol/drug use disorders through a family tree, and smoking status. We collected clinical data on the presence of cirrhosis (yes/no, according to clinical examination, ultrasonography, and routine liver function tests) and treatment with psychotropic medicines (benzodiazepines). Mean alcohol consumption was evaluated using Timeline Followback method (Sobell et al., 2001). Cannabis, cocaine, and heroin consumption were based on declarative data and urinary tests.

2.2. Methods

2.2.1. MoCA

We used the 7.1 version of the MoCA translated into French as provided by the MoCAtest organization (http://www.mocatest.org/). The MoCA consists of 13 tasks measuring the following eight cognitive domains: visuospatial/executive, naming, memory (not scored), attention (3 different items with separate scoring), language (2 different items with separate scoring), abstraction, delayed recall, and orientation. A total score is calculated by summing scores of the 13 tasks. The maximum score possible is 30 points, and the cut-off of normal value in AUD is ≤ 25 (Ewert et al., 2018). The scoring grid was defined in accordance with the guidelines proposed (Rossetti et al., 2011), but the total score was recorded as uncorrected for educational level according to Ewert et al. (2018).

2.2.2. BEARNI

We used the version proposed by Ritz et al. (2015). The BEARNI evaluates 5 different domains: visuospatial abilities, executive functions, ataxia, verbal episodic memory, and verbal working memory. The episodic memory subtest consists of a delayed free recall of a 12-word list read aloud during 2 learning trials, while working memory is assessed with an alphabetical span subtest. Flexibility abilities are assessed with an alternating verbal fluency subtest. The visuospatial subtest includes 5 complex figures, each containing 2 separate hidden figures that the patient has to find. Finally, the ataxia subtest requires patients to stand on each foot in turn for 30 s, first with eyes open, then with eyes closed. The performance in each domain is scored, giving a total score (maximum score: 30 points) and a total cognitive score (excluding the ataxia subtest; maximum score: 22 points). The respective scores were calculated following the published guidelines. The proposed cut-off for the total score are ≤ 19 or ≤ 21 for patients with a low (less than 12 years) and high (≥ 12 years) education level, respectively, and ≤ 16 or ≤ 17 for the cognitive score; each sub-score also has its own normal value.

2.2.3. Battery of neuropsychological tests

We selected the French version of validated tests which specifically assess the functions corresponding to the different domains explored by the MoCA and the BEARNI tests. These included executive functions (the Trail Making Test, TMT (Reitan, 1958) adapted version by the Godefroy and "*Groupe de Réflexion pour l'Evaluation des Fonctions Exécutives*" (2001)), the Stroop test (Stroop, 1935), the adapted GREFEX version and fluency tasks (Cardebat et al., 1990), verbal episodic memory (the FCSRT (Grober et al., 1988) adapted French version (Van der Linden and Juillerat, 2004)), working memory (digit span subtest of the Wechsler Adult Intelligence Scale (Wechsler, 2011)), and visuospatial skills (the Rey-Osterrieth Complex Figure, ROCF (Tremblay et al., 2015)). These tests were shown to correlate with the MoCA (Ewert et al., 2018) and the BEARNI (Ritz et al., 2015).

The raw result of each test was transformed either in z score (Goldstein and McNeil, 2012) or in percentile. A score at a task was considered abnormal when the z score fell 1.65 standard deviation (SD) below norms corrected for age, education, and sex, or below the 5th percentile. A cognitive domain was considered impaired when at least one of the corresponding test scores deviated from normal, except in the executive domain, which was considered as impaired when at least two different test scores were abnormal. The cognitive deficit was qualified as mild and moderate to severe when only one and two or more domains were impaired, respectively.

2.2.4. Administration of the tests

About 7–10 days after alcohol withdrawal, patients were first administered either the MoCA or BEARNI, and the other test was administered on the following day to minimize fatigue and interference. The administration order was defined using a randomization table. Administration was performed in a quiet room in the morning by occupational therapists or neuropsychologists experienced with the test. Patients were seated and had not smoked recently. The day following the last screening test, patients were administered the neuropsychological battery tests by a neuropsychologist who was blind to the MoCA and the BEARNI test results.

2.3. Statistical analysis

Quantitative values were described using their number, mean,