

# Neuropsychological Assessment of Cognitive Function in Chronic Alcohol-dependent Patients and Patients with Alzheimer's Disease

IOANNIS LIAPPAS<sup>1</sup>, IOULIA THEOTOKA<sup>1</sup>, ELISABETH KAPAKI<sup>2</sup>, IOANNIS ILIAS<sup>3,4</sup>,  
GEORGE P. PARASKEVAS<sup>2</sup> and CONSTANTINE R. SOLDATOS<sup>1</sup>

*Departments of <sup>1</sup>Psychiatry and <sup>2</sup>Neurology, Athens National University,  
School of Medicine, Eginition Hospital, Athens;*

*<sup>3</sup>"Klimax" Support Foundation, Athens;*

*<sup>4</sup>Department of Pharmacology, Medical School, University of Patras, Rion, Patras, Greece*

**Abstract.** *Background: Heavy and chronic alcohol dependence and Alzheimer's disease may share some neuropsychological characteristics. Patients and Methods: The pattern of neuropsychological characteristics of 33 alcohol-dependent patients who reported memory disturbances were evaluated and compared to the neuropsychological performance of 38 patients with mild-stage Alzheimer's disease and 73 healthy subjects, serving as controls. Alcohol-dependent patients were examined with tools concerning the pattern of alcohol abuse and problems related to alcohol consumption. All groups completed a full battery of neuropsychological tests for the assessment of cognitive functions, such as different kinds of memory, attention, executive function etc. Results: Alcohol-dependent patients fared worse compared to the control subjects in every test used. The comparison of alcohol-dependent patients versus patients with Alzheimer's disease showed that the latter are much more burdened, as far as cognition is concerned, in all aspects of memory. Conclusion: Alcohol-dependent patients, even if they are not demented, have mild cognitive impairment in all domains of cognition (memory and frontal functions) in comparison with controls which performed within the norms. Verbal fluency, working memory and frontal functions were impaired at the same degree in alcohol-dependent patients and in patients with Alzheimer's disease. Memory problems were more pronounced in Alzheimer's disease patients.*

*Correspondence to:* Dr. Ioulia Theotoka, 5 Kapsali Street, Athens, GR-10674, Greece. Tel: +30 6932 380673, Fax: +30 210 7753240, e-mail: iliathetotoka@yahoo.com

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Heavy and chronic alcohol dependence may lead to various psychiatric symptoms (1) and cognitive deficits (2) of varying degrees of severity. Many neuropsychological and psychometric studies have evaluated these deficits. The interpretation of their results is often difficult due to the variability of the evaluated symptoms and the different methods used.

Alzheimer's disease is a syndrome characterized by deficits in several cognitive domains, particularly in memory (3). Despite the heterogeneity of neuropsychological deficits in Alzheimer's disease patients, memory impairment is the predominant characteristic, followed by aphasic and apraxic symptoms.

The aim of the present study was to evaluate the pattern of neuropsychological characteristics of alcohol-dependent patients who report memory disturbances, to compare this pattern with the neuropsychological performance of patients with mild Alzheimer's disease and evaluate the existence of a possible distinct neuropsychological pattern that could differentiate early-stage Alzheimer's disease from alcohol-related dementia.

## Patients and Methods

*Patients.* Three groups of patients were examined: the first group comprised 33 chronic alcohol-dependent patients (27 men, 6 women; mean age (SD): 64.8 (8.3) years; mean duration of alcohol abuse (SD): 24.3 (8.1) years). These patients had contacted the Drug and Alcohol the Addiction Clinic of the Athens University Psychiatric Clinic at Eginition Hospital. Patients voluntarily sought treatment for alcohol abuse/dependence. All patients fulfilled the DSM-IV diagnostic criteria for alcohol abuse/dependence (4) and were admitted at this specialized department for alcohol detoxification on an inpatient basis. The patients had been abstinent from alcohol for an average of one day prior to admission to the department. Participation in the project was on a voluntary basis. Detailed

information on the objectives of the study and the research therapeutic protocol was provided to all patients. All provided their informed consent. Ethical permission for the study was obtained from the special scientific committee of the hospital and the procedures followed were in accordance with the declaration of Helsinki (5). For inclusion in the study patients had to fulfil the following criteria: age >50 years, absence of serious physical illness, absence of other pre- or coexisting major psychiatric disorder on the DSM-IV axis I, absence of other drug abuse and absence of complaints of memory disturbances. Alcohol abusers who also fulfilled a DSM-IV diagnosis of depressive or anxiety disorder prior to the onset of alcoholism were excluded from the study.

A general clinical and biochemical medical screen was performed to exclude severely impaired individuals. Upon admission, alcohol detoxification was initiated and completed over one week. Detoxification comprised vitamin replacement (vitamin C, E, B complex) and oral administration of diazepam (10-40 mg/day in divided doses) with gradual taper-off over one week (6). Alcohol consumption was prohibited during hospitalisation.

The second group consisted of 38 age-matched patients with mild-stage Alzheimer's disease (15 men, 23 women; mean age $\pm$ SD: 63.8 $\pm$ 6.9 years) that attended the Memory Clinic of the Department of Neurology of the Athens University. Only patients with a Mini Mental State Examination (MMSE; see below) score over 19 were included.

The third group consisted of 73 healthy people serving as controls (42 men, 31 women; mean age $\pm$ SD: 64.6 $\pm$ 4.8 years).

*Measures.* Alcohol-dependent patients were diagnosed with the Schedules for Clinical Assessment in Neuropsychiatry (7) and assessed through the Composite International Diagnostic Interview (CIDI) (8), for the pattern of alcohol abuse, potential major life problems related to alcohol consumption and the occurrence of withdrawal symptoms in the past. This questionnaire includes items related to lifetime, past year and past month frequency and quantity of alcohol use. All data pertaining to alcohol use were self-reported. Data thus collected have been shown to be a valid source of information in the case of dependent individuals (9).

Alzheimer's disease patients were diagnosed by two experienced neurologists, according to the NINCDS-ADRDA criteria (10).

All groups completed a full battery of neuropsychological tests. For the group of alcohol-dependent patients, these tests were administered sixty days after admission to the hospital in order to avoid possible interference from the tranquillisers administered. Tests administered included the Mini Mental State Examination (MMSE), a screening and staging instrument for the assessment of dementia; the Syndrome Short-Test (SKT); a test which assesses attention, naming, immediate and delayed recall, recognition memory and cognitive rigidity; the Clock Test, which assesses visuoconstructive ability; the Verbal Fluency Test (Letter and Category), which evaluates verbal and executive function; and the Digit Span Forward and Backward (WAIS-R), which evaluates attention, immediate and working memory.

*Statistical analysis.* Comparisons of the results of neuropsychological tests between participants was made using Analysis of Variance with post-hoc Student-Newman-Keul's test, except for SKT subtests 1 to 9, where the Kruskal-Wallis test was used. Values of  $p < 0.05$  were considered to be statistically significant.

## Results

The control group did not show any cognitive disturbances in any of the tests used. The alcohol-dependent group obtained poorer scores than the control group on every test used, which indicates that alcohol-dependent patients have mild cognitive impairments in many domains without having dementia (Table I). More specifically, these mild cognitive defects concerned attention, memory (immediate, delayed recall and recognition memory), visuoconstructive ability, verbal fluency and working memory. The overall comparison of the alcohol-dependent group to the Alzheimer's group suggested that the latter's scores were lower for measures of cognition, in all aspects of memory (immediate and delayed recall, recognition memory) and also in naming, attention and cognitive rigidity. However, in the domains of verbal fluency, visuoconstructive ability, working memory and processing speed of information, the scores of the alcohol-dependent group and Alzheimer's group were more similar.

## Discussion

In this study, alcohol-dependent patients performed worse than controls in all neuropsychological tests, which indicates that even alcohol-dependent patients, who are not demented (since our alcohol-dependent patients had on average MMSE scores >25), have mild cognitive impairment in all domains of cognition (memory and frontal functions), such as verbal fluency, working memory and cognitive rigidity.

Concerning the comparison between patients who were alcohol-dependent and those with Alzheimer's disease, it was found that the latter performed worse in all memory tests (immediate and delayed recall, working memory), as expected since Alzheimer's disease affects mainly memory. Alzheimer's disease patients also performed worse than alcohol-dependent patients in naming attention and cognitive rigidity. However, alcohol-dependent patients do not have impairment of episodic memory or in acquisition of new information, as verified by recognition memory. However, they have the same degree of deterioration as patients with Alzheimer's disease in verbal fluency, visuoconstructive ability, immediate recall and working memory. All these aspects of cognition concern executive functions of the frontal lobes. More precisely, in the Verbal Fluency Test (Category and Letter), the individual was asked to perform an active search, coding and recalling from the semantic network, which is a frontal lobe activity. Additionally, immediate recall and working memory also have frontal and attention components. It was found that domains of active search and semantic organization and

Table I. Results of neuropsychological testing in alcohol-dependent patients, patients with Alzheimer's disease and controls.

Test	Alcohol-dependent patients (1)	Alzheimer's disease (2)	Controls (3)
MMSE	25.33 (8.18)	24.82 (3.98) <sup>a</sup>	29.05 (0.84)
SKT overall	8.46 (6.05) <sup>d</sup>	14.10 (5.93) <sup>b,c</sup>	1.64 (1.42)
SKT <sub>1</sub>	0 <sup>d</sup>	0 <sup>b,c</sup>	0
SKT <sub>2</sub>	1 <sup>d</sup>	2 <sup>b,c</sup>	0
SKT <sub>3</sub>	0	1 <sup>b,c</sup>	0
SKT <sub>4</sub>	1 <sup>d</sup>	2 <sup>b,c</sup>	0
SKT <sub>5</sub>	1 <sup>d</sup>	2 <sup>b,c</sup>	0
SKT <sub>6</sub>	1 <sup>d</sup>	1 <sup>c</sup>	0
SKT <sub>7</sub>	1 <sup>d</sup>	2.5 <sup>b,c</sup>	0
SKT <sub>8</sub>	1 <sup>d</sup>	2 <sup>b,c</sup>	1
SKT <sub>9</sub>	1 <sup>d</sup>	1.5 <sup>b,c</sup>	0
Verbal Fluency Test (Category)	10.48 (3.39)	11.26 (3.80)	19.63 (3.64) <sup>c,d</sup>
Verbal Fluency Test (Letter)	6.96 (3.24)	6.76 (2.83)	18.79 (4.89) <sup>c,d</sup>
Clock Test	5.53 (1.95)	5.15 (2.44)	6.94 (0.22) <sup>c,d</sup>
Digit Span- Forward	5.62 (1.20)	5.97 (1.15)	6.61 (1.01) <sup>c,d</sup>
Digit Span- Backward	3.00 (1.09)	3.15 (0.82)	5.03 (0.68) <sup>c,d</sup>

MMSE: Mini Mental State Examination; SKT: mean (SD) values except SKT<sub>1</sub>-SKT<sub>9</sub> where median values are presented; <sup>a</sup>since only patients with MMSE scores > 19 were included no comparisons of this assessment were made among the study groups; <sup>b</sup> $p < 0.05$  for (1) vs. (2); <sup>c</sup> $p < 0.05$  for (2) vs. (3), <sup>d</sup> $p < 0.05$  for (1) vs. (3).

processing are impaired in alcohol-dependent patients; sometimes this impairment is at the same level as patients with Alzheimer's disease. This finding is related to the frontal lobe dysfunction in alcohol-dependent patients. These tests describe aspects of executive function and reflect frontal lobe function and dysfunction but not temporal function, which is involved in memory.

Numerous studies with alcohol-dependent patients have shown the deterioration of cognitive function, ranging from amnesic disorder to mild cognitive impairment and to dementia (11). Nevertheless, it is unclear whether such cognitive deficits are reversible with abstinence. An association between alcohol abuse and cognitive deficits was observed in many studies. Tuck and Jackson, in a large sample of alcohol-dependent patients ( $n=641$ ) found that frontal lobe dysfunction (58%) and short-term memory loss (32%) were the most frequent cognitive abnormalities (12), while dementia was relatively uncommon (4%). Parsons and Nixon also corroborated frontal lobe dysfunction in alcohol-dependent patients and found that episodic memory, abstraction, problem-solving and perceptual motor abilities were also affected (13). In alcohol-dependent patients, poor consolidation and deficits in recall have been observed (2). In other studies of alcohol-dependent patients, deficits were disclosed in context and working memory (14), which were further supported by electrophysiological evidence of working memory deficits in alcohol-dependent patients (15). The frequency of cognitive impairment increases

with age (16). As Blow *et al.* indicate, between the ages of 60-69 years, dementia occurs in 9% and from 70 years and onwards in 18.4% of alcoholics (17). However, it is not easy to precisely determine whether age increases the neurotoxicity of alcohol or if alcohol accelerates the aging process.

The mild cognitive deficit observed in alcohol-dependent patients does not mainly involve memory problems, contrary to that in Alzheimer's disease patients. Thus, it appears that the neuropsychological profile of alcohol-dependent patients is distinct from that of Alzheimer's disease patients. Regarding clinical practice, this distinction should be taken into consideration when alcoholics are evaluated for the concomitant presence of Alzheimer's disease. The level at which the mild cognitive deficit observed in alcohol-dependent patients remains stable needs to be investigated, as does whether it deteriorates to mild cognitive impairment (MCI) according to the criteria set by Petersen (18), or to early dementia. Furthermore, it seems necessary to assess how this cognitive impairment in alcohol-dependent patients evolves when they continue to drink or are abstinent. All these issues are important to clinicians who assess the short- and long-term cognitive impairments of alcoholics presenting with memory problems in clinics. Additionally, taking into account the behaviour and personality alterations of alcoholics with cognitive impairments, these issues have implications for pharmacological and non-pharmacological therapies that both patients and their kin need to realize and accept.

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