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Original Research Article

Cognitive impairment in alcohol dependence syndrome: A cross-sectional study using MoCA

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Abstract

Background: Alcohol Dependence Syndrome (ADS) is associated not only with physical and psychological consequences but also with significant cognitive impairment, often overlooked in clinical settings. Early identification of cognitive deficits is essential for tailoring effective interventions and improving treatment adherence.

Objective: To assess cognitive functioning in patients with Alcohol Dependence Syndrome and examine its association with demographic and clinical variables.

Materials and Methods: A cross-sectional observational study was conducted among 110 male inpatients diagnosed with ADS at a tertiary care hospital in Western India. Cognitive functioning was assessed using the Montreal Cognitive Assessment (MoCA), with a score below 26 indicating cognitive impairment. Socio-demographic and clinical data were collected using a semi-structured proforma. Statistical analyses were performed using chi-square tests and independent t-tests.

Results: Cognitive impairment was observed in 21 (19.1%) patients. The most affected cognitive domains included attention, visuospatial/executive functions, and delayed recall ($p < 0.01$). A significant association was found between the duration of alcohol consumption and cognitive impairment ($p = 0.025$), with higher prevalence among those consuming alcohol for more than 20 years. Although a greater proportion of patients with lower education showed impairment, the association was not statistically significant ($p = 0.102$). No significant differences were found in language and abstraction scores.

Conclusion: A substantial proportion of ADS patients exhibit early cognitive deficits, particularly with prolonged alcohol use. Routine cognitive screening using tools like MoCA should be incorporated into standard care to guide individualized management and rehabilitation strategies.

Keywords: Alcohol dependence syndrome, Cognitive impairment, MoCA, Chronic alcohol use, Duration of alcohol consumption.

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1. Introduction

Alcohol Dependence Syndrome (ADS) is a chronic and relapsing condition characterized by a strong compulsion to consume alcohol, tolerance, withdrawal symptoms, and a progressive neglect of alternative pleasures or interests. Beyond its well-established physical and social harms, chronic alcohol use exerts significant neurotoxic effects on the brain, leading to cognitive impairments even in the absence of overt neurological complications. These cognitive deficits may affect various domains including attention, memory, executive function, and visuospatial skills, which can severely hinder treatment adherence and social functioning among affected individuals.[1-3]

Neuroimaging and neuropsychological studies have identified structural and functional abnormalities in multiple brain regions such as the prefrontal cortex, hippocampus, cerebellum, and frontocerebellar circuitry in individuals with chronic alcohol use.[4-6] Cognitive impairments may be subtle

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in early stages but are reported in up to 50–80% of chronic alcohol users depending on the tools and criteria used for assessment.[7] The Montreal Cognitive Assessment (MoCA) is a validated, sensitive tool for the early detection of mild cognitive impairment and has been increasingly used in the assessment of alcohol-related cognitive dysfunction.[8] However, there is a paucity of Indian studies investigating early cognitive deficits in newly diagnosed ADS patients, especially in structured healthcare settings. This study aims to evaluate the prevalence and profile of cognitive impairment among ADS patients using the MoCA, and to explore its association with demographic and alcohol use variables.

2. Materials and Methods

This cross-sectional observational study was conducted over 18 months at a General Hospital Psychiatry Unit of a tertiary care multi-specialty hospital in western India. The study included 110 male inpatients newly diagnosed with Alcohol Dependence Syndrome (ADS) based on ICD-10 criteria confirmed through clinical interviews. Inclusion criteria were age between 25 and 60 years, ability to provide informed consent, and adequate literacy for cognitive testing. Patients were excluded if they had comorbid psychiatric conditions (e.g., psychosis, severe depression), neurological illnesses (e.g., seizure disorders, head trauma), HIV, liver cirrhosis, current alcohol withdrawal, or were transferred during hospitalization. The final sample was determined based on hospital records and statistical calculation assuming a 50% prevalence of cognitive impairment, a 5% margin of error, and a 95% confidence interval, yielding a minimum required sample size of 86. However, 110 eligible participants were ultimately enrolled to improve study power.

Cognitive functioning was assessed using the Hindi version of the Montreal Cognitive Assessment (MoCA), a brief, 30-point tool covering domains such as attention, executive function, memory, language, visuospatial ability, abstraction, delayed recall, and orientation. A cut-off score of <26 was used to define cognitive impairment. The test was administered after a 7-day washout period following any benzodiazepine detoxification to avoid drug-related influence on cognition. Socio-demographic data were recorded using a semi-structured proforma. Ethical approval was obtained from the Institutional Ethics Committee, and written informed consent was secured from all participants. Data were entered in Microsoft Excel and analyzed using IBM SPSS Statistics Version 26.0 software. Descriptive statistics were used for demographic variables. Group comparisons were made using unpaired t-tests for continuous variables and chi-square or Fisher's exact tests for categorical variables, with statistical significance set at $p < 0.05$.

3. Results

The results of the study are based on data from 110 male patients with Alcohol Dependence Syndrome. Cognitive impairment was observed in 19.1% of the participants as per MoCA scores. The findings are presented with respect to demographic variables and their association with cognitive status.

Table 1: Socio-demographic and clinical characteristics of the study participants

Variable		Frequency	Percentage
Age (years)	<=30	18	16.4%
	31-40	57	51.8%
	41-50	23	20.9%
	>=51	12	10.9%
Education	High school or less	44	40.0%
	Intermediate	58	52.7%
	Graduation	8	7.3%
Marital status	Married	106	96.4%
	Unmarried	4	3.6%
Religion	Hindu	102	92.7%
	Muslim	4	3.6%
	Christian	3	2.7%
	Sikh	3	2.7%
Number of children	None	5	4.5%
	1-2	86	78.2%
	3-4	19	17.3%
Duration of alcohol consumption	5-10	38	34.5%
	11-20	67	60.9%
	>20	5	4.5%
Cognitive impairment	Mild ((MOCA <=26))	21	19.1%
	No (MOCA >26)	89	80.9%

Table 2: Comparison of cognitive domain scores and age between patients with and without cognitive impairment

	Cognitive impairment (n=21)		No impairment (n=89)		t-stat	p-value
	Mean	SD	Mean	SD		
Age (years)	39.6	9	36.1	6.9	1.67	0.052
VEF Score	3.8	0.6	4.8	0.3	-7.42	<.01
Naming memory score	2.9	0.4	3.4	0.1	-2.14	0.036
Attention score	4.2	0.4	5.1	0.5	-8.81	<.01
Language score	2	0.1	2	0.2	0.01	0.998
Abstraction score	1.8	0.4	2	0.5	-1.96	0.091
Delayed recall score	3.2	0.6	4	0.6	-5.5	<.01

Table 3: Association of education and duration of alcohol consumption with cognitive impairment

Variable		Cognitive impairment	No impairment	Chi-square	p-value
Education	<=10th	15 (71.4%)	46 (51.7%)	1.94	0.102
	> 10th	6 (28.6%)	43 (48.3%)		
Duration of alcohol consumption (years)	5-10	4(19.0%)	34 (38.2%)	7.36	0.025
	11-20	14 (66.7%)	53 (59.6%)		
	>20	3 (14.3%)	2 (2.2%)		

Table 1 presents the socio-demographic and clinical characteristics of the 110 study participants diagnosed with Alcohol Dependence Syndrome. The majority of participants were aged between 31 and 40 years (51.8%), had intermediate-level education (52.7%), and were married (96.4%). Most patients reported a duration of alcohol consumption between 11 and 20 years (60.9%). Cognitive impairment, as assessed by the MoCA, was present in 19.1% of the subjects.

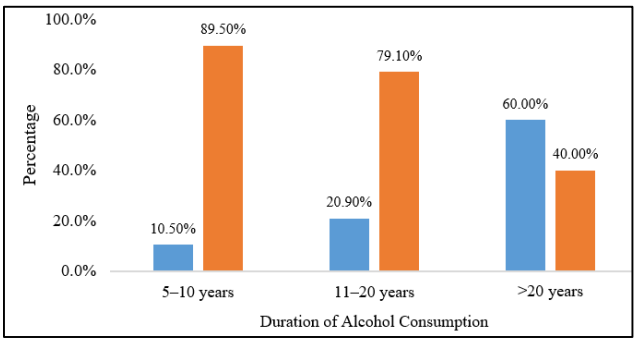

Figure 1: Distribution of cognitive impairment by duration of alcohol consumption

As shown in **Figure 1**, higher proportion of cognitive impairment was observed with increasing duration of alcohol consumption. Among patients with over 20 years of alcohol use, 60% had cognitive impairment, compared to only 10.5% in the 5–10 year group. This suggests a possible association between longer alcohol use and increased cognitive dysfunction.

Table 2 compares the cognitive domain scores and age between patients with and without cognitive impairment. Patients with cognitive impairment had significantly lower scores in visuospatial/executive function, naming memory, attention, and delayed recall ($p < 0.05$). The mean age was slightly higher in the impaired group, though this difference approached but did not reach statistical significance ($p = 0.052$). No significant differences were observed in language or abstraction scores.

Table 3 shows the association of education and duration of alcohol consumption with cognitive impairment. Although cognitive impairment was more prevalent among participants with education up to 10th grade, the association was not statistically significant ($p = 0.102$). However, a significant association was found between the duration of alcohol consumption and cognitive impairment ($p = 0.025$), with the highest impairment seen in those consuming alcohol for more than 20 years.

4. Discussion

This study assessed cognitive functioning in patients with Alcohol Dependence Syndrome (ADS) using the Montreal Cognitive Assessment (MoCA), revealing that 19.1% of participants exhibited mild cognitive impairment. This finding is consistent with previous studies that reported cognitive deficits in 20–50% of patients with chronic alcohol use, even in the early phases of abstinence or without overt neurological symptoms.[3,7,9] The use of MoCA, a brief and sensitive tool for detecting mild cognitive impairment, proved effective in identifying dysfunction across multiple domains, especially attention, memory, and executive functioning, which are known to be particularly vulnerable in alcohol-related neurotoxicity.[8]

A significant association was noted between the duration of alcohol use and cognitive impairment. Participants with more than 20 years of alcohol consumption had markedly higher rates of cognitive dysfunction, consistent with previous literature that links prolonged alcohol use with brain atrophy and white matter degeneration, particularly in the prefrontal cortex and hippocampus.[2,5] This supports the hypothesis that chronic alcohol exposure leads to structural and functional disruptions in brain circuits governing attention, working memory, and executive functions. These

findings emphasize the cumulative impact of alcohol on neurocognitive health and the importance of early screening in long-term users.[10]

Educational level showed an inverse relationship with cognitive impairment, with higher rates among individuals educated up to 10th grade. Although this association was not statistically significant in this study, similar trends have been reported elsewhere and are often explained by the concept of cognitive reserve, where individuals with higher education levels are believed to possess more efficient neural networks or compensatory strategies to delay the manifestation of cognitive deficits.[11,12] A meta-analysis by Meng and D'Arcy confirmed that individuals with lower educational attainment are at greater risk of alcohol-related neurocognitive disorders, even after controlling for age and socioeconomic factors.[13] Furthermore, emerging literature has highlighted the role of social factors, including marital status and family structure, in buffering cognitive decline among patients with substance use disorders.[14]

The present study had a few limitations. As a cross-sectional, hospital-based study involving only male participants from a single center, its generalizability is limited. The exclusion of females prevents evaluation of gender-based cognitive differences, though evidence suggests women may be more susceptible to alcohol-induced brain changes even at lower levels of consumption.[15] Nonetheless, the study underscores the value of MoCA as a practical tool for routine screening of cognitive functioning in ADS patients. Early identification allows for timely cognitive rehabilitation and psychosocial support, which are essential for improving functional outcomes, enhancing treatment adherence, and preventing relapse.

5. Conclusion

This study highlights that a significant proportion (19.1%) of patients with Alcohol Dependence Syndrome exhibit mild cognitive impairment, particularly affecting attention, memory, and executive functions. Longer duration of alcohol consumption was significantly associated with greater cognitive decline. Although education level showed a trend, it was not statistically significant. Early screening using tools like the MoCA can aid in timely detection and management of cognitive dysfunction in ADS patients, ultimately supporting better treatment outcomes and rehabilitation.

6. Ethical Approval

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7. Conflict of Interest

The authors declare that there is no conflict of interest.

8. Source of Funding

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