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Research Paper

Cognitive Deficits and Alcohol Dependence Syndrome – A Paradigm Relationship

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ABSTRACT

Background- Chronic alcohol use causes not only physical consequences but causes cognitive deficits also. 50 and 80% of the Alcohol dependent syndrome patients present with cognitive deficits. These cognitive deficits will significantly contribute to poor functional outcomes which lead to reduced health related quality of life. ***Objectives***- 1. To assess Cognitive deficits in Alcohol Dependent syndrome (ADS). 2.To find the relationship between early onset of alcohol use, duration of Alcohol use and large quantity of alcohol use with Cognitive deficit pattern. ***Method***- A cross sectional study was done on 38 patients with ADS, aged 18- 45 years, education $\geq 7^{th}$ std, with no major psychiatric or medical co-morbidities. AUDIT scale was administered to look for dependence pattern, CIWA scale was applied to look for withdrawal symptoms. MoCA scale was applied to screen for cognitive impairment in patient with MMSE score (25 and above). In subjects with cognitive impairment on MoCA scale (25 and below), neuropsychological assessment was done using neuropsychological battery of test from NIMHANS Neuropsych battery standardised on Indian Population. ***Results***-There was impairment in the Cognitive domains as follows, speed of processing (BACS - 100%), attention (DF- 97%) working memory (DF-97%, DB-100%, LNS - 84%), visual memory (100%), visuo-spatial memory (78%), executive functions (CT2 -92%), reasoning and problem solving (maze- 81%) in majority and a significant relation between early onset of alcohol use, duration of Alcohol use. ***Conclusions***- There is a significant impairment in the areas of speed of processing, attention, executive functions, reasoning and problem-solving domains. Significant association between Age of onset of ADS (Early onset) with Executive functions. Attention domain was found to be associated with longer duration of alcohol intake, whereas working memory deficits was associated with large quantity of alcohol intake.

Keywords: *Cognitive Deficits; Alcohol Dependent Syndrome; Neuropsychological Assessment*

Chronic alcohol consumption induces cognitive impairments mainly affecting executive functions, episodic memory, visuo-spatial capacities and metacognitive abilities, with associated impairment in emotional processes and social cognition. Deficits in

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problem solving, verbal and nonverbal abstraction, visuo- motor coordination, learning, and memory have been reported.[1,2]

Studies have shown that patients with chronic alcohol dependence related cognitive dysfunction have reduced antioxidant enzymes, free radical dependence or antioxidant enzymes are inactivated, suggesting that alcohol causes the body to produce oxidation products and reduce antioxidant activity, and long-term exposure of neurons to such an environment will undoubtedly produces irreversible damage to the central nervous system and further affects cognitive function.[3] Research has found that light to moderate drinking might provide protection against cognitive decline .[4,5,6]

Studies on alcoholism have highlighted impairments affecting episodic memory as well as semantic and cognitive procedural learning.[7,8,9] More recently, deficits in prospective [10], autobiographical [11,12]and source memory [13] have been reported in individuals with alcohol use disorder.

Working memory deficits in alcoholics is associated with a diminished neural efficiency between the cerebellum and frontal regions and are associated with duration of drinking.[14,15,16]

Specific detriments in visuospatial learning and memory have been associated with significant demyelination within the corona radiata within the cerebellum in an alcoholic sample. [17,18,19]

Hence this study is to identify cognitive dysfunctions or deficits in alcohol dependent patients who are out of withdrawal symptoms.

Objectives

- To assess Cognitive deficits in Alcohol dependent syndrome.
- To assess the relationship between early onset, duration of alcohol use and quantity of alcohol use with Cognitive deficit pattern.

METHODOLOGY

Source of data: patients attending department of psychiatry in Victoria hospital who fulfilled the diagnostic criteria for ADS, fulfilling inclusion and exclusion criteria.
Ethical clearance was obtained from the Institutions Ethics committee.

A. Study design: Cross- sectional study
B. Place of study: BMCRI and attached hospital, Bangalore.
C. Inclusion criteria:
- Those fulfilling ICD 10 criteria for ADS.
- Age between 18 to 45 yrs
- Education 7th std and above

D. Exclusion criteria:
- Other Axis 1 psychiatric diagnosis except nicotine dependence syndrome.
- Patient with severe medical and Neurological condition (head trauma, stroke, deficiency state)

E. Hypothesis: - Specific Cognitive Domain deficits are present in ADS subjects.
F. Sample size: 38

G. Duration of study: November 2018 to May 2020

H. Study tools:

1. Informed consent form
2. Semi structured proforma to collect data regarding socio demographic profile and history regarding illness
3. AUDIT Scale [20]
   The Alcohol Use Disorders Identification Test (AUDIT) is a 10-item screening tool developed by the World Health Organization (WHO) to assess alcohol consumption, drinking behaviours, and alcohol-related problems.
4. CIWA Scale [21]
   Clinical Institute Withdrawal Assessment for Alcohol (CIWA-A) was devised by Shaw et al in 1981. [22] It is a 15 item scale and could be applied It was later modified to 10 item scale called CIWA-Ar* which was more efficient without any loss in accuracy (r=0.99), reliable and valid.
   5.MoCA Scale. The Montreal Cognitive Assessment (MoCA) Test [23] was used as a screening test for detection of cognitive impairments in these patients, as this tool is more sensitive than the Mini Mental State Examination (MMSE) for mild-to-moderate cognitive impairments. [24]
   6.Neuropsychological battery of tests to assess various cognitive domains Neuropsychological assessment was done using NIMHANS neuropsychological battery of test. In this battery, each cognitive domain was tested by selecting specific test which is standardised for Indian population.

COGNITIVE DOMAINS	NEUROPSYCHOLOGICAL TESTS
1.Speed of processing	Colour trial- 1 Digit symbol substitution test
2. Attention/Vigilance	Digit forward and Digit backward test
3. Working Memory	Digit forward and Digit backward test Wechsler Memory Scale- Letter Number Sequencing
4. Verbal Learning/Memory	Hopkins Verbal Learning Test–Revised (HVLT-R)
5.Visual Learning/Memory	6 figure test
6.Visuo spatial functions	Bender- Gestalt test (BGT)
7.Executive function	Colour trial test-2 Tower of London test
8.Reason and problem solving	Maze test

These tests were applied on the patients who fulfilled the inclusion criteria under the Supervision of Qualified and certified Neuropsychologist.

Method

Patients attending psychiatry facility fulfilling alcohol dependence Syndrome criteria according to ICD 10 and fulfilling the inclusion/ exclusion criteria were included in the study. Socio- demographic and clinical variables were collected. AUDIT scale was applied. In this individual Clinical institute withdrawal assessment (CIWA) scale was applied to see if withdrawal symptoms are present or absent, if the withdrawal symptoms were present study was postponed till the subject was out of withdrawal. If the subject is out of withdrawal symptoms study was continued by applying Montreal cognitive assessment (MoCA) scale to know if cognitive impairment was present or not. MoCA score of 25 or lesser means cognitive impairment is present. MoCA was applied to subjects with normal MMSE score

(25 and above). MoCA scale was applied to all subjects and taken to study only if the score was less than 25 with normal MMSE score (25 and above). Hence, all 38 subjects had MoCA score less than 25. Then Neuropsychological assessment battery was applied to test domains like attention, language, memory, visuo-spatial and executive functions.

Statistical Analysis

Pearson correlation coefficient was used to access correlation of cognitive functions and age of onset of drinking, duration of alcohol use, quantity of alcohol use.

RESULTS

The results of the study is as follows:

Total number of study participants – 38. Mean age – 30.87 (± 5.32) years. 61% of Study participants were between the age group of 26-35 yrs. All the study participants were male (100%).

1. **Age of Onset of Drinking Alcohol**
   55% of study participants had alcohol use initial age of onset being 25yrs, and 45% belonged to this group.
2. **Duration of Alcohol Use in Years**
   32% of study participants consumed alcohol for 11- 25 yrs and a majority of 68% consumed alcohol for nearly 10 yrs.
3. **Quantity of Alcohol**
   55 % of participants consumed 12-20 units of alcohol per day, 45% of participants consumed 21-24 units of alcohol per day.

Table 1 - Performance of study participants on various cognitive domains

Domain and test	Patients without Deficits n(%)	Patients with Deficits n(%)
SPEED OF PROCESSING		
Colour Trail-1	36(94%)	2(5%)
BACS-SC	11(28%)	27(71%)
ATTENTION		
Digit forward	1(3%)	37(97%)
WORKING MEMORY		
Digit forward	1(3%)	37(97%)
Digit backward	0(0%)	38(100%)
LNS	6(15%)	32(84%)
VERBAL MEMORY		
HVLT	32(84%)	6(15%)
VISUAL MEMORY		
6 figure test	0(0%)	38(100%)
VISUO SPATIAL MEMORY		
BGT	8(21%)	30(78%)
EXECUTIVE FUNCTIONS		
colour trial 2	3(8%)	35(92%)
TOL	33(86%)	5(13%)
REASON AND PROBLEM SOLVING		
Maze test	7(19%)	31(81%)

Majority of them had impairment in speed of processing, Attention, working memory, visual learning, visuo-spatial memory, executive functions, reasoning and problem solving in our study.

Table 2 – correlation between duration of alcohol use and cognitive functions

Variable	**Duration of Alcohol use**
Speed of processing-COLOUR TRIAL 1	0.1366(0.413)
Speed of processing -BACS-SC	0.0968(0.562)
ATTENTION -DF	.353*(**0.029**)
working memory DF	.353*(**0.029)**
working memory -DB	-0.0106(0.949)
- working memory -LNS	-0.1389(0.405)
VERBAL MEMORY-HVLT	-0.02139(0.898)
VISUAL MEMORY-6 figure test	0.1698(0.308)
Executive function -colour trial- 2	0.2373(0.151)
Executive function -TOL	-0.091(0.586)
Reason and problem solving-Maze test	0.082(0.624)

There was a weak positive correlation between duration of alcohol use and working memory and attention which was found to be statistically significant (p=0.029).

Table 3 – correlation between age of onset and cognitive functions

Variables	**Age of Onset**
Speed of processing-COLOUR TRIAL 1	0.069(0.679)
Speed of processing -BACS-SC	0.150(0.366)
ATTENTION -DF	0.026(0.876)
working memory DF	0.026(0.876)
working memory -DB	0.162(0.328)
- working memory -LNS	0.054(0.745)
VERBAL MEMORY-HVLT	0.115(0.489)
VISUAL MEMORY-6 figure test	0.087(0.601)
Executive function -colour trial- 2	-0.085(0.611)
Executive function -TOL	0.354***(0.02**)
Reason and problem solving-Maze test	0.095(0.569)

The test signifies for executive function-TOL had p value 0.02 which was statistically significant, indicating participants with younger age of onset have more impairment in executive function.

Table 4 – correlation between quantity of alcohol use and cognitive functions

Variables	**Quantity If Alcohol Use**
Speed of processing-COLOUR TRIAL 1	-0.106(0.525)
Speed of processing -BACS-SC	0.225(0.175)
ATTENTION -DF	0.003(0.987)
working memory DF	0.003(0.987)
working memory -DB	-0.375* (**0.02**)

Variables	Quantity If Alcohol Use
- working memory -LNS	-0.416** (**0.009**)
VERBAL MEMORY-HVLT	0.178(0.285)
VISUAL MEMORY-6 figure test	-0.214(0.197)
Executive function -colour trial- 2	0.035(0.836)
Executive function -TOL	0.032(0.849)
Reason and problem solving-Maze test	0.119(0.479)

**. Correlation is significant at the 0.05 level (2-tailed).*
***. Correlation is significant at the 0.01 level (2-tailed).*

There was negative correlation between quantity of alcohol use and working memory signifying quantity of alcohol use increases impairment in working memory.

DISCUSSION

The results reveal the cognitive impairment profile of ADS patients in our study.

1. **Duration of alcohol use** and **working memory and attention** was found to be statistically significant.
2. Participants with **younger age of onset** had more impairment in **executive function**.
3. **Quantity of alcohol use** increased impairment in **working memory.**

Strengths

- The present study highlights the cognitive impairment profile in ADS patients.
- Specific test was selected for the assessment of cognitive domains.
- Association between cognitive functioning, clinical variables and alcohol related variables was assessed.

Limitations

- The study sample was clinical and relatively small, which have limited the power to detect significant association and probably biased our results.
- MoCA was taken instead of Brief Cognitive Screen for Alcohol Use Disorder (BCS-AUD)

Future directions

- To conduct study in larger population and in non-clinical sample.
- Longitudinal follow up study can be planned.

CONCLUSION

- The Cognitive Domains found to be affected are Attention, working memory and Executive functions.
- Significant association between age of onset of ADS (Early onset less than 25 yrs) with Executive function domain was present.
- The Attention Domain is found to be associated with longer duration of alcohol intake, Executive function domain was associated with Early Age of onset ADS (less than 25 years),
- Working memory deficits was associated with severity (Large quantity) of Alcohol intake.

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Conflict of Interest
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