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TO SEE NEUROPSYCHOLOGICAL FUNCTIONING OF SUBSTANCE ABUSERS

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ABSTRACT

Introduction- Chronic use of psychoactive substance is associated with wide-spread deficits in neuropsychological functioning. The prevalence of cognitive impairment varies from 30-80%. The major brain regions affected are dorso-prefrontal cortex and anterior cingulated cortex. This study was aimed to see neuropsychological functioning of Substance Abusers.

Material and Methods- The study was conducted on 50 known substance dependent patients diagnosed as per ICD-10 criteria at Dayanand Medical College & Hospital, Ludhiana. After obtaining consent, patients were evaluated for cognitive functioning with PGI Battery of Brain Dysfunction designed for Indian population by Dwarka Pershad and Santosh K. Verma(3rd edition 2015). The battery includes five subtests-Memory Scale, Revised Bhatia's short battery of performance tests of intelligence, Nahor Benson test, Verbal adult intelligence scale and Bender visual motor gestalt test. Patients with head injury, seizure disorder and any other psychiatric disorder on Axis- I were excluded.

Results- In present study severe dysfunction were found in overall intellectual functioning. In Bender visuo-motor coordination major areas indicating dysfunction were perseveration, rotation and added angles which reveals that fine motor movements of patient are highly disorganized. They were also showing problem in abstract thinking and reasoning in day to day life. They performed poorly on performance IQ parameter where visuo-motor coordination and analytical capacities are highly required. These findings are clearly supporting frontal lobe dysfunction which are very important for executive functioning of day to day life which in turn requires more extensive management strategies so that relapse can be prevented.

Conclusion- Since relapse is major problem in treating drug addicts, the present study reveals dysfunction in the areas which are inhibiting the patient to live their life independently. These areas should be focused to prevent relapse.

KEYWORDS : substance abuser, cognitive impairment, executive functioning

Introduction

Drug addiction is seen as a chronic relapsing disorder with persistent brain alterations associated with cognitive, motivational and emotional alterations.[1]The full extent of drugs' impacts on cognition is not yet known, but research indicates that addicted individuals have alterations in brain regions including the striatum, prefrontal cortex, amygdala, and hippocampus [2].These same regions underlie declarative memory—the memories that define an individual, without which it would be difficult to generate and maintain a concept of self. [3]Drug abuse impacts neuropsychological functioning both directly by altering neuro-chemistry, and indirectly by means of non-neurological systems.[4]The brain region and neural processes that underlie addiction overlap extensively with those that support cognitive functions, including learning, memory, and reasoning.These areas include Dorso-lateral prefrontal cortex and anterior cingulated cortex.[5]Substance abuse is associated with structural & functional abnormalities of these areas leading to cognitive impairment, compromised critical skills, increased distractibility and deficits in working memory .[6]Substance abusers show specific deficits of attention as opposed to a general decline of attention at treatment intake .[7]Recent reviews characterize addiction as a two-stage process. In the first stage, the individual's occasional drug taking becomes increasingly chronic and uncontrolled. The neurological source of these symptoms is drug-induced deregulation of the brain's reward system .[8] Normally, increased dopamine signaling within this system—specifically, in the ventral striatum or nucleus accumbens (NAc)—produces pleasurable feelings that orient organisms to seek and perform life-sustaining conditions and activities, such as locating supportive environments, eating, and having sex. Drugs of abuse hyperactivate this system, triggering abrupt and large increases in NAc dopamine signaling, producing intense sensations that motivate additional drug taking, and promoting the formation of maladaptive drug-stimulus associations.[9]

COGNITIVE DEFICITS IN CHRONIC DRUG ABUSE

- Cocaine— deficits in cognitive flexibility (Kelley et al.,2005)[10]
- Amphetamine— deficits in attention and impulse control (Dalley et al., 2005)[11]
- Opioids— deficits in cognitive flexibility (Lyvers and Yakimoff, 2003)[12]
- Alcohol— deficits in working memory and attention (Moriyama et al., 2006)[13]
- Cannabis— deficits in cognitive flexibility and attention (Pope, Gruber, and Yurgelun- Todd, 2001)[14] and
- Nicotine— deficits in working memory and declarative learning(Kenney and Gould, 2008)[15]

AIMS & OBJECTIVES-

The present study is planned to see neuropsychological functioning of Substance Abusers

MATERIALS & METHODS

- 50 patients who were presenting to psychiatry department of Dayanand Medical College & Hospital, Ludhiana in outdoor and indoor facility with a diagnosis of mental and behavioural disorder due to psychoactive substance use as per ICD-10(both OPD and IPD) were taken up for the study.
- Cognitive impairment was assessed using PGI brain dysfunction battery after taking the informed consent.

PGI brain dysfunction battery is a measure of cognitive impairment consisting of following subtests:

- Verbal Adult Intelligence Scale
- Revised Bhatia's Short Battery of Performance Tests of Intelligence
- PGI Memory Scale
- Nahar and Benson Test
- Bender Visuo-Motor Gestalt Test

Total time taken was approximately two hours for each patient.

PARAMETERS TO BE TAKEN FOR ANALYSIS

- 1. Socio-demographic data
- 2. Cognitive functioning

RESULTS AND CONCLUSIONS

Table -1 Socio demographic variables

AGE (years)	Number of patients
Upto30	10
31-40	10
41-50	5
>51	25

EDUCATION	
Upto Matric	30
Matric To Upto Graduation	12
Post Graduation	8

Table -2. Cognitive functions on different PGI-BBD

Sr.no	Cognitive Parameters	Score	Percentage
1	Remote Memory	0	0%
2	Recent Memory	8	16%
3	Mental Balance	2	4%
4	Attention and concentration	2	4%
5	Delayed Recall	2	4%
6	Immediate Recall	8	16%
7	Retention of Similar Pairs	0	0%
8	Retention of Dissimlar Pairs	4	8%
9	Visual Retention	2	4%
10	Recognition	4	8%
11	P/K X100	2	4%
12	Performance Quotient (PQ)	26	52%
13	T.Q on information	6	12%
14	T.Q on digit span	10	20%
15	T.Q on arithmetic	28	56%
16	T.Q on comprehension	8	16%
17	Verbal Quotient (VQ)	28	56%
18	Nahar-Benson test	30	60%
19	Bender -Gestalt test	40	80%

Table -1 shows the socio-demographic profile of the patients in which majority of them were above the age of 51 and educated up to metric.

Table -2 shows that the most affected cognitive function in substance abusers in our study reflects gross visuo-motor coordination difficulty (80%). This may be due to effect of substances on motor area of the brain. This finding is also supported by poor performance on Performance IQ (52%)which in addition reveals poor analytical capacity of the abusers. Overall 56% of the abusers showing significant scatter in their verbal and performance quotient that indicate significant organic impairment (PQ-VQ). In this verbal intelligence parameter, almost all of them were poor on arithmetical parameter (TQ-A 56%).

Majority of the included patient were showing normal performance on information, attention and concentration, and comprehension parameters.

DISCUSSION:

Cognitive impairment in substance abusers is appearing as a major challenge for professionals, for their poor recovery rates and relapses. These impairments are reported in literature but what should be the strategy to overcome these challenges in treatment of addiction is still not very clear. Most of these studies used the single parameter to evaluate cognitive function. The present study is directed towards the exploration of the impact of substances on cognitive functioning of addicts in Punjab. The Punjabi patients come for treatment in Outdoor and Indoor patient department of Psychiatry were evaluated on a full neuropsychological battery covering broad range of cognitive functions to see the pattern of cognitive impairments and possible explanation as well explore possible treatment strategies required to help these problems.

Most of the subjects in our sample show severe problems in visuomotor coordination (80%) on BVMG and 60% on Nahar Benson test irrespective of age and education. This shows that substance of abuse definitely affects visuo-motor skills, spatial relations and perceptual behavior thus indicating a dysfunction in the areas of brain which control these functions.

As per Hanson et al average alcohol use and average drug withdrawal symptoms over the 10-year follow-up appeared most predictive of visuospatial construction skills in young adulthood. Also the cumulative effects of protracted substance use and withdrawal during mid- to late adolescence and into young adulthood appear related to long-term cognitive functioning in the mid-twenties, particularly visuospatial construction and visual and verbal memory.[16] This is in sync with our study which indicates a significant deficit on BVMG & Nahar-Benson test along with a dysfunction of 56 % on verbal quotient.

The association of poorer visuospatial and memory performance with protracted substance use is in concordance with previous reports from this longitudinal study, as well as other investigators.[17,18]

Chronic stimulant use may also influence visual memory functioning, and more recent substance use may have a specific impact on executive functions. Similar results have been produced by Adams, Rennick, Schoof, and Keegan who found polydrug abusers to be impaired on tasks requiring rapid visuomotor set-shifting and conceptual flexibility.[19]

Miller analysed that types of neuropsychological deficits found in the polydrug group and showed that verbally mediated problem solving and perceptuomotor functions were most severely affected. This is very much similar to the findings of our study.

Deficits in processing visual and spatial information have been found related to substance use disorders in general, but especially in alcohol use disorders [17,18].

Individuals with a history of long-term opiate abuse and dependence may suffer cognitive impairments, primarily within the domain of executive functioning, with higher order functions being more impaired in comparison to basic executive components [20]. Executive dysfunctions in these individuals have been linked to functional abnormalities of the (dorsolateral) prefrontal cortex. In addition, long-term opiate addicts may also have emotional disturbances associated with dysfunctions of limbic structures and the orbitofrontal cortex [21].

These findings co-relate with those of our study which shows dysfunction in BVMG, which is an indicator of perceptual behavior including interpretation and organization.

Another study reflects the disturbance of cognitive flexibility, perceptual tracking, sequencing of events, sustained and divided attention and graphomotor skills. [22] This denotes the disturbed functions of lateral temporal lobe which is the brain area responsible for reception of stimuli, reduction of irrelevant stimuli, sending relevant information to frontal lobe to start to achieve. Moreover, the results of this confirm that patients may have significant impairments in their abilities to; track any task to the end, arrange events, maintain attention and resist irrelevant stimuli. This finding is one of the important factors behind failure of patients to maintain abstinence, marriage, study or work.[22]

In our study almost all the patients were showing poor performance in arithmetical ability, which is well known sensitive part of neuropsychological batteries where even in normal subjects this parameter can show impairment. There is a vast literature that supports the hypothesis that prolonged exposure to drugs of abuse produces specific deficits in cognition [23,24].

Converging evidence from epidemiological and clinical trials with humans, as well as animal research, suggests that the major cognitive domains affected by chronic exposure to drugs of abuse are impulsivity, cognitive flexibility and attentional bias. In addition, chronic drug use can also affect learning and memory, as well as being associated with suboptimal decision-making styles.[25]

Alcohol abuse is associated with deficits in abstraction, long-term memory and visuospatial ability and indeed can lead to symptoms of dementia, while chronic users of cannabis show deficits in episodic memory, attention, psychomotor speed and verbal skills [23,24].

This supports the findings in literature that dorsolateral prefrontal cortex and cingulate cortex are definitely affected with these substances and these areas are well known to regulate learning memory and reasoning. These same regions underlie declarative memory that defines an individual without which it would be difficult to generate and maintain a concept of self [3].Drug capacity to act upon the substrate of declarative memory suggests that their impact on cognition is extremely far reaching.

Several studies on alcohol and other substance use disorders have reported poorer performance on tasks assessing attention and/or working memory functioning using either visual or auditory-verbal stimuli.[18] Differences in attention and working memory have been found in relation to a range of substances, but they may be especially associated with alcohol use disorders [20].

Since learning ,memory and reasoning are grossly affected, then the other day to day functioning will obviously be poor that is why 52% of our sample are performing poorly on performance intelligence(PQ= 52%) which supports above findings. Impairment in the above areas leads to poor decision making which in turn blocks further growth in life of the patient which push them further towards addiction again.

Chronic substance abuse is associated with neurophysiological and neuroanatomical changes, as well as cognitive impairment, that affect quality of life, occupational functioning, and the ability to benefit from therapy.

On the other hand, various studies in the area have pointed out the existence of neuropsychological impairments that are produced as a result of drug use. These impairments seem to be associated with the cumulative neurodegenerative effects exerted by the drugs on several brain areas, and can affect the visual–perceptor, visual motor, attentional, memory and executive functions (10).

Recent works show that chronic use of psychoactive substances produce significant deficits in executive control functions (ECF), and, particularly, in domains related with response inhibition and decision making. These deficits have been associated with anterior cingulate (ACC)/prefrontal cortex (PFC) dysfunction. Accordingly, recent neuroscientific models of addictive behavior have proposed a critical role of PFC circuitry in the breakdown of inhibitory control that characterizes transition from casual- recreational drug use to substance dependence [1,2,9]. In summary, the neuropsychological alterations prior to the drug use and existence of neuropsychological impairments that are produced as a result of drug use can explain these results.

The deaddiction strategies in INDIA is focused mainly on detoxification of the patient in indoor setup without addressing above limitations and concern of the patient makes substance abusers leading towards poor outcome and frequent relapses. A comprehensive treatment strategy with biological, psychological and social difficulty will definitely help the patient to come out of addiction and adapt better in their day to day life responsibilities.

CLINICAL IMPLICATIONS

- The literature reviewed here highlights the importance of considering past and present cognitive function when treating patients for addiction, as drug-related cognitive changes may bias patients toward responses and actions that contribute to the cycle of addiction.
- Clinicians face the challenge of helping patients master adaptive strategies to overcome the strong associations that contribute to relapse when patients return to environments associated with their prior substance use.
- In addition, cognitive deficits may hinder patients' ability to benefit from counseling, and more sessions and/or reminders may be necessary to aid these patients in incorporating abstinence-sustaining strategies into their daily routines.
- A better understanding of how substances of abuse change cognitive processes is needed to develop new therapeutic agents to treat addiction and ameliorate cognitive deficits and both substance abuse and cognitive impairment need to be addressed in order to reduce hospitalizations and time in the hospital.
- A well planned and focused CBT strategies can help to improve adaptability and in turn preventing relapses.

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