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A Study of Response Inhibition in Bipolar Mania

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Abstract:

Background: *It is largely accepted that response inhibition plays a key role in bipolar disorder. However, the effect of specific role played by various sub-facets of response inhibition remains largely unknown.* ***Objective:*** *The present study aims to see various sub-components of response inhibition in patients diagnosed with BPAD current episode manic type.* ***Method:*** *Purposive sampling was used to select 20 patients with diagnosis of BPAD current episode manic type (based on ICD-10 DCR) (group 1) from a tertiary care hospital. Another 20 normal healthy subjects (group 2) were taken from accompanying person on the score of less than 3 in GHQ-12. Both the groups were matched on age, sex and education level obtained through initial assessment on socio-demographic clinical data sheet. All the subjects (n=40) were assessed using Stroop Color and Word Test and Wisconsin Card Sorting Test and Sidedness Bias Schedule on both the groups. The collected data were analysed by using probability statistics.* ***Results:*** *There was a statistically significant difference between group 1 and group 2 on measures of Perseverative responses, Percent perseverative responses, Perseverative errors, Percent perseverative errors in WCST. On Stroop Test, Word Score (W), Color Score (C), Color- Word Score (CW) and Trails to complete first category.* ***Conclusion:*** *The findings of this study suggest that response inhibition more present in patients with BPAD than normal subjects.*

Key words.: *Response Inhibition, Bipolar Affective Disorder, Mania.*

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I. INTRODUCTION

Bipolar Affective Disorder is an abnormal fluctuation in moods, varying between marked highs (mania) and lows (depression) with periods of stability. Bipolar disorder often develops in a person‘s late teens or early adult ears. At least half of all cases start before age 25. Some people have their first symptoms during childhood, while others may develop symptoms late in life. But bipolar disorder can be treated, and people with this illness can lead full and productive lives. Cognition is an important component of Bipolar disorder. The cognitive deficits may result in the inability to: Pay attention, Process information quickly, Remember and recall information, Respond to information quickly, Think critically, plan, Organize and solve problems, Initiate speech. . Inhibitory functions are integral part of the cognitive processes that generate and control behaviours designed to provide specific solutions to dealing with environmental demands. Thus response inhibition is the cognitive process required to cancel an intended movement. The ability to inhibit prepotent or reflexive attentional and behavioural reactions and to stop unnecessary or inappropriate behavior develops over the years. These developments free one from interference by otherwise dominant tendencies. This, in turn, enables a person to exercise choice and attention over his or her actions. “Inhibition” refers to mechanisms by which the nervous system suppresses information, restricts its use, or restrains its transmission from one area of the brain to another. Inhibition may be defined as a multifactor cognitive process that includes distinct neuropsychological mechanisms (Ridderinkhof et al, 2004). One central inhibitory mechanism is “interference control”, because the ability to inhibit response to irrelevant information is critical for protecting goal-directed behaviour (Barkley, 1997; Kornblum et al, 1999; Nigg, 2000). Aron et al (2004) defines it as the ‘suppression of responses, S-R mappings or task-sets when the context changes, and suppression of interfering memories during retrieval’. The neural substrates that have been implicated in response inhibition deficits are the orbitofrontal cortex, sub cortical regions and the distributed neural circuits that connect these regions (Baxter et al, 1987, 1988; Rauch et al, 1994).

Inhibitory functions are integral part of the cognitive processes that generate and control behaviors designed to provide specific solutions to dealing with environmental demands. Thus response inhibition is the cognitive process required to cancel an intended movement. Although there is some evidence for impaired response inhibition in symptomatic bipolar patients (Clark et al, 2002) there are inconsistent findings regarding such impairments in remitted or euthymic bipolar patients. Findings from several studies

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indicate no impairment in euthymic bipolar patients (Cavanagh et al, 2002; van Gorp et al, 1998), while others report deficits in these patients (Ferrier et al, 1999, 2002; McGrath et al, 1997).

According to Verdoux and Liruad (2000) found similar impaired performance in bipolar disorder patients and schizophrenics on the Stroop task when compared to healthy controls. Study by Morrice et al (1990) found similar results in 20 bipolar disorder patients in the same task when compared to healthy controls. Similarly Ali et al (2000) studied 36 bipolar disorder patients on the Stroop task and found impaired performance when compared to healthy controls and McGrath et al (1997) studied 18 manic patients aged between 18 to 65 years, on the Stroop test and found impaired performance when compared to healthy controls.

It is largely accepted that response inhibition plays a key role in bipolar disorder. However, the effect of specific role played by various sub-facets of response inhibition remains largely unknown. Cognition is an important component of daily functioning. In bipolar disorder, cognitive dysfunction may be the most sensitive indicators of incomplete remission. Researchers have found different domains of cognitive dysfunctions among patients with acute bipolar mania even during remission period. Current study aims as assessing Response Inhibition among patients during acute phase of mania.

II. MATERIALS AND METHODS

The present study aims to see various sub-components of response inhibition in patients diagnosed with BPAD current episode manic type hospital based cross-sectional study conducted at Central Institute of Psychiatry (CIP) Ranchi, Jharkhand.

III. SAMPLE SIZE

Purposive sampling was used to select 20 patients with the diagnosis of BPAD current episode manic type (based on ICD- 10 DCR) and their performances were compared with 20 normal healthy subjects who scored less than 3 in GHQ-12. Both the groups were matched on age and sex.

INCLUSION CRITERIA FOR EXPERIMENTAL GROUPS

- Patients with the diagnosis of bipolar affective disorder current episode manic type (ICD-10 DCR, WHO, 1993).
- Male and female patients aged between 20– 45 years.
- Patients with YMRS score more than 15.
- Those who are willing to give informed consent.

IV. EXCLUSION CRITERIA FOR EXPERIMENTAL GROUPS

- Patients with the comorbid diagnosis of any other psychiatric illness.
- Patients with the history of substance dependence (except Caffeine and Nicotine)
- Patients with the history of significant head injury or serious medical illness

V. INCLUSION CRITERIA FOR CONTROL GROUP

- General Health Questionnaire -12 score < 3.
- Age and sex matched to the experimental group.
- Those who are willing to give informed consent.

VI. EXCLUSION CRITERIA FOR CONTROL GROUP

- With the history of any psychiatric illness
- With the positive family history of serious psychiatric illness
- History of major medical or neurological disorder or any neurosurgical procedure
- History of substance abuse (except nicotine and caffeine).

VII. MATERIAL & TOOLS TO BE USED

- Socio-demographic and clinical data sheet.
- General Health Questionnaire – 12 (GHQ-12) (Goldberg & Williams, 1988).
- Young Mania Rating Sale (YMRS) (Young et al, 1978).
- Stroop Color and Word Test (Golden & Freshwater, 1998).
- Wisconsin Card Sorting Test (Heaton et al, 1993).

VIII. PROCEDURE FOR DATA COLLECTION

Patients fulfilling the inclusion and exclusion criteria were taken up for the study. Written informed consent was taken from the patients after explaining the objectives and procedure of the study in detail. Socio-demographic data was collected from all the study subjects. General Health Questionnaire-12 (GHQ-12) was applied on normal controls. YMRS was used on patients population. Stroop Colour Word Test and Wisconsin Card Sorting test was administered on both patients and normal controls.

IX. STATISTICAL ANALYSIS

Chi-square was used in order to compare the discrete demographic variables between the two groups and t-test was used to compare patient and normal controls by using advanced version of SSPS 19.0 for Windows.

X. RESULTS

Table 1: Group comparison on age and education between experimental and Control Group.

Variables	Bipolar Mania Group N=20	Control Group N=20	t, df=38	P
	Mean±SD	Mean±SD		
Age	27.20±4.14	27.20±4.14	.000	1.000
Education	11.20±2.09	10.67±2.02	1.01	0.951

Not Significant

Table 1- Shows the mean age and education of the experimental (Patients with Bipolar mania) and the Control Group. The groups did not differ significantly on these two variables.

Table 2: Group comparison on socio-demographic variables between experimental (patients with Bipolar mania) and Control Group.

Variables		Bipolar mania Group N-%		Control Group N-%		Chi square df=1	P	Fisher exact
Sex	Male	15	75%	15	75%	.000	1.000	1.000
	Female	5	25%	5	25%			
Religion	Hindu	17	85%	17	85%	.000	1.000	1.000
	Non-Hindu	3	15%	3	15%			
Habitat	Rural	12	60%	8	40%	1.600	.206	.343
	Urban	8	40%	12	60%			
Family Type	Nuclear	5	25%	3	15%	.625	.429	.695
	Joint	15	75%	17	85%			
Occupation	Employed	0	0%	4	20%	4.444	.035*	.106
	Un-employed	20	100%	16	80%			
Marital status	Married	7	35%	9	45%	.417	.519	.378
	Un-married	13	65%	11	55%			

**p< .01 *p< .05

Table 2- shows group comparison on other socio-demographic variables between experimental (patients with bipolar mania) and Control group. The groups was significant difference found on occupation (*p<.05).

Table 3: Group comparison response inhibition between experimental (patients with Bipolar mania) and Control Group.

Variables		Bipolar mania Group N=20 Mean±SD	Control Group N=20 Mean±SD	t, df=38	P
WCST	Perseverative responses	42.200±23.996	17.850±9.969	4.191	.000**
	Percent perseverative responses	32.900±18.741	14.950±7.141	4.003	.000**
	Persevrative errors	34.800±18.721	16.250±8.527	4.033	.000**
	Percent perseverative errors	27.100±14.534	13.550±6.073	3.847	.000**
SWCT	Word Score (W)	61.400±15.052	81.300±7.189	-5.335	.000**
	Color Score (C)	39.700±11.002	65.250±11.030	-7.334	.000**
	Color- Word Score (CW)	22.050±9.144	48.200±11.124	-8.121	.000**

**p<.01*p<.05

Table 3: There was a statistically significant difference between group 1 and group 2 on Perseverative responses, Percent perseverative responses, Perseverative errors, Percent perseverative errors, in WCST. On Stroop Test, Word Score (W), Color Score (C), Color- Word Score (CW).

XI. DISCUSSION

Present study was a cross-sectional, hospital-based, comparative study. Some aspects of the methodology used in this study are discussed below which would be followed by the discussion. During the testing a few precautionary measures were adopted. Testing was conducted in the laboratory, which was a relatively quiet place. Both the groups were explained about the tasks in hand and only after proper understanding of the same the testing began. The statistical analysis of the data tries to probe into the fact of whether there exits any significant difference between patients with bipolar affective disorder current episode mania and normal controls with respect to their profiles of Response inhibition. Some findings of the study have brought out certain basic differences with respect to the selected variables amongst the two groups.

However, before discussing the results in terms of hypotheses, it is imperative to discuss some other relevant factors such as socio-demographic variables. There is significant difference found in terms of occupation 0% of the patient group is employed and 100% is unemployed where in normal control group 20% is employed and 80% is unemployed. The significant difference was found in experimental group which may be due to the illness of the patients and they were unable to do work.

In the present study it was found that there was significant difference on WCST, in respective variables like, perseverative responses, percent perseverative responses, perseverative errors and percent perseverative errors between experimental group and control group. Wisconsin Card Sorting Test (WCST) was used to assess planning and organization, problem solving, response inhibition, cognitive flexibility, conceptualization, abstract reasoning, set shifting, processing speed, self-monitoring, utilizing error feedback and rule abstraction. Thus WCST can be considered as a measure of response inhibition, requiring the ability to develop and maintain an appropriate problem solving strategy across changing stimulus conditions in order to achieve a future goal. Similar to other measures of executive functions, WCST requires strategic planning, organized searching, utilizing environmental feedback to shift cognitive sets, directing behaviour toward achieving a goal, and modulating impulsive responding.

According to Carla et al (2006) found that there was significant difference found in patients with bipolar II disorder, as well as the bipolar I group, showed a trend towards a higher number of WCST perseverative errors compared with healthy controls.

In the same table the bipolar group was found to be significantly impaired in this domain i.e., they failed to inhibit their response in view of the more potent one. The usual explanation of the Stroop interference effect is based upon the assumption that as word reading is an automatic or habitual process, it interferes with the ink color naming which is a more controlled and voluntary process. Thus, the disproportionate slowness in the incongruent task is typically due to an increased susceptibility to interference and a deficit in inhibition processes that are actively involved in selective attention (Barch et al, 1999; Dollfus et al, 2002; Zalla et al, 2004).

Thus, in the present study, manic patients had difficulty in these executive processes as can be seen from their performances on the test. This finding is consistent with the study of Jones et al (1994) on stable bipolar disorder patients. He compared a group of bipolar disorder patients to normal controls on several tests, one of which was the Stroop color word Test. His study indicated that the bipolar disorder patients performed worse than the normal controls on the Stroop test. Ali et al (2000) found similar differences between stable BD patients and normative data on the Stroop test. Similarly, McGrath et al (1997) found that BD patients performed worse than controls on the Stroop test, both while in acute episode as well as in the sub-acute recovery phase.

However, some studies have differed in their findings, Dixon et al (2004) compared three bipolar groups, namely, manic, depressed and remitted with normal controls on the Stroop Neuropsychological Screening Test (SNST) to assess cognitive inhibition using the colour – word score (i.e., number of correct responses minus number of incorrect responses). The authors found that all the bipolar groups showed poor performance on the Stroop test in comparison to normal controls, but manic patients were not more impaired than the depressed patients on the inhibitory control index of the Stroop task. The authors found that the remitted group shared cognitive deficits with the other two patient groups and concluded that such cognitive deficits could be representing trait markers of bipolar illness.

XII. CONCLUSION

The findings of this study suggest that response inhibition was poor among patient with acute mania than normal control. This study has replicated the previous finding of many studies.

XIII. LIMITATIONS

- Sample size was small.
- Sampling was done in a purposive manner which if it had been randomized would have led to greater generalizability.
- Effect of medication was not controlled and their impact on task performance is unclear.
- Instead of cross-sectional design, a prospective or longitudinal study would have yielded more information.

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