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ORIGINAL ARTICLE

Cognitive-emotional Processing in Borderline Personality Disorder: A Comparative Study

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ABSTRACT

Background: Individuals having borderline personality disorder (BPD) show impulsive behaviors, intense and unstable emotional regulation with a disturbance in interpersonal relations and unstable sense of self. Studies show that emotional processes can influence various neuro-cognitive functions such as information processing and Decision making. However, there is a dearth of studies examining the role of these processes in BPD. This study aimed to examine the emotional biases of cognitive processes and decision-making ability of patients with BPD.

Materials and methods: A sample of 40 adult individuals (20 BPD patients and 20 nonpsychiatric controls), males and females, were selected. They were assessed using the emotional stroop test (EST) and the Iowa gambling task (IGT).

Results: Findings indicated that though the study group had an overall slow information processing and poor response inhibition, they had greater emotional biases towards stimuli laden with negative affect which was reflected as greater interference on the negative EST. Findings from the IGT indicated impulsivity and poor decision-making ability in the study group. Further analysis revealed that the study group had slow feedback utilization.

Conclusion: From the present study, it can be concluded that individuals with BPD do have certain deficits in cognitive-emotional processing.

Keywords: Borderline personality disorder (BPD), Decision making, Emotional processing, Response inhibition

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BACKGROUND

Borderline personality disorder (BPD) is a significant health problem with a prevalence of 1 to 2% in the general community.[1,2] Patients with BPD often experience a considerable amount of impairment in general functioning, they have marked impulsivity, and have high levels of anger and hostility,[3] so much so that not only does BPD present as a problem, it also presents as a challenge to mental health professionals owing to its prognosis, very poor response to treatment and high suicide completion rates of about 10%.[4] Various etiological theories have been proposed to understand this disorder such as cognitive theory,[5] borderline personality organization from an object relations perspective,[6] biosocial theory[7] and so on. Most of these theories emphasize the psychological and environmental underpinnings of this disorder with much less emphasis on the neurobiological and neuropsychological factors.

If one looks at this disorder from the bio-psycho-social perspective, one can understand that this disorder is actually a product of the interaction between the biological, psychological and environmental factors. If one discusses the neuropsychological deficits in BPD, there is a considerable amount of neuropsychological research which provides empirical evidence to support the idea that individuals with BPD have various cognitive impairments.[8] However, the extent to which cognitive impairments are the result of psychological distress versus physiological abnormalities is uncertain. A study by Bazanis et al. showed that on decision-making tasks, individuals with BPD tend to make delayed and maladaptive choices when they have to choose between competing actions, while they respond impulsively, in a disinhibited manner while they are gambling on the outcome of their decisions.[8] The BPD patients also showed impairments on the planning task. Literature also suggests a genuine deficit of response inhibition in patients with BPD[9] and these difficulties become even more pronounced when they are required to suppress their reaction to negative emotion as noted in an event related potentials (ERP) study of borderline patients,[10] thereby indicating that emotion might have influenced information processing.[11]

Some studies have suggested reduced hippocampal and amygdalar volumes in BPD patients compared to healthy controls, and both these brain areas are associated with affect regulation and emotion.[12,13] Apart from structural abnormalities in the amygdala and the hippocampus, reduced volumes have been found in frontal regions,[14] for example in the orbitofrontal and ventromedial prefrontal cortex (OFC, VMPFC), the dorsolateral prefrontal cortex (DLPFC) and the anterior cingulate cortex (ACC),[15] in the superior parietal cortex and the precuneus.[16] Van Reekum found that neuropsychological testing on BPD showed evidence of frontal and possibly primarily orbital-frontal system dysfunction in the form of impulsivity, cognitive inflexibily, poor self-monitoring, and perseveration.[17]

Some of the findings on these neuropsychological domains are contradictory. For example, there are specific studies that show impairments in response inhibition in BPD with respect to emotional stimuli,[18] while there are certain studies that show no such associations.[19] There are also certain areas of neuropsychological functioning that are relatively less explored in the case of BPD. Decision making and feedback-utilization are some of those areas that are not very well explored concerning BPD. Moreover, as compared to neurobiological studies, there are not many neuropsychological studies in the domain of BPD. It is not only important to explore the brain areas affected in this disorder, but it is also essential to explore how these impairments in the various brain areas affect their functioning, and how are cognitive and emotional domains related in case of BPD.

AIMS AND OBJECTIVES

This study aimed to examine the emotional biases of cognitive processes and decision-making ability of patients with BPD.

MATERIALS AND METHODS

Sample

The sample consisted of 20 individuals each in BPD group (study group) and nonpsychiatric comparative group and hence, the total sample size was 40.

The study group consisted of individuals diagnosed by trained psychiatrists and clinical psychologists as having a diagnostic and statistical manual of mental disorders-fourth edition (text revision) (DSM-IV-TR)[20] diagnosis of BPD, and they were recruited from the outpatient services of a tertiary care psychiatry hospital in Kolkata, West Bengal, India. Individuals having comorbid substance dependence and psychosis (except brief psychotic episode) were excluded from the study. The mean age of the study group participants was 23.10 ± 5.13 years.

The nonpsychiatric comparative group consisted of individuals without any psychiatric illness, currently or in the past. They were recruited from the community and had a mean age of 23.05 ± 2.5 years.

Study Design

The present study was a cross-sectional comparative study based on purposive sampling method.

Tools Used

Semi-structured sociodemographic and clinical data sheet: It was prepared especially for the study in order to elicit basic socio-demographic details (such as age, sex, educational qualification), family history of psychiatric illness, history of current illness and co-morbidities (study group), and history of psychiatric illness, if any (both groups).

- *General Health Questionnaire–12 (GHQ–12):*[21] In the present study, GHQ–12 was used as a screening tool for the comparative group, where only those individuals who scored 2 or less than 2 were included in the sample. The tool has internal consistency reliabilities (alphas) of 0.66 to 0.94, and test-retest reliabilities of 0.24 to 0.81.
- *Edinburgh Handedness Inventory:*[22] In the present study, this test was used as a screening tool to find handedness, where only those individuals who right-handed were included in the sample. It has an internal consistency of 0.93.[23]
- *Modified Mini Screen (MMS):*[24] The MMS was used as a screening tool to screen the individuals in the comparative group for Axis I disorders, where only those individuals who scored 5 or less than 5 were included in the sample. A score of above 5 indicates that the person needs a detailed psychological assessment. Its internal consistency is excellent (0.92). It has high Inter-rater agreement (0.92) and also has a high Test–retest reliability (0.79).
- *Standardized Assessment of Personality–Abbreviated Scale (SAPAS):*[25] The SAPAS was used as a screening tool to screen the individuals in the comparative group for Axis II disorders, where only those individuals who scored 3 or less than 3 were included in the sample. A score of above 3 indicates the likelihood of the presence of personality disorder. The alpha coefficient for the total score of the SAPAS is 0.68. It has a sensitivity of 0.92 and a specificity of 0.84.
- *International Personality Disorder Examination (IPDE):*[26] The DSM-IV version of IPDE was used in the present

study, and it was administered only on the study group to confirm the diagnosis of the borderline personality disorder. The IPDE has been found to have high inter-rater reliability ranging from 0.71 to 0.92 for the various personality disorders, while it was 0.89 for the borderline personality disorder.

- *Emotional Stroop Test (EST):* The emotional Stroop task, developed by Williams, Mathews, and MacLeod,[27] is used as an information-processing approach to assess the emotions. For the present study, three lists of 13 words each were prepared. List one comprised of 13 negative affect words; List two comprised of 13 neutral words such as names of objects; while List three comprised of 13 positive affect words. The list containing the negative affect words was prepared, taking into consideration the negative emotions experienced by individuals with BPD such as "mistrust, betrayal, anger, rejection" and so on. The subjects were shown each list, and they were supposed to name the color in which each of the words was written. Time taken for each list was recorded. In the present study, this tool was administered as a measure of response inhibition and to see the effect of emotion on response inhibition.
- *Iowa Gambling Task (IGT):* The IGT is a psychological task thought to simulate real-life decision making and was introduced by Bechara, Damásio, Tranel, and Anderson.[28] The IGT investigates the possibility that problems with decision-making are the result of hypersensitivity to reward (i.e., large immediate gain outweighs even larger future loss). Participants are presented with four virtual decks of cards (A to D) on a computer screen. The goal of the game is to win as much money as possible.

The computerized version of IGT in the psychology experiment building language software (PEBL, version 0.13) was used in the present study. PEBL is an open source software system for designing and running psychological experiments.[29] The scoring was done using the concept of gain-loss frequency (GLF), wherein the frequency of loss, and not the amount of loss, was taken into consideration. As per GLF method, the decks B and D are the advantageous decks as the frequency of loss is less in them, while the decks A and C are disadvantageous ones as the frequency of loss is more. The frequency of loss in the advantageous decks and disadvantageous decks is irrespective of the amount of loss. A net score was computed by subtracting the total number of cards selected from advantageous minus disadvantageous decks (B + D)–(A + C) for each block of 20 card selections (i.e., four blocks in total). The total score, i.e., the total amount earned at the end was also recorded.

In the present study, the IGT was used as a measure of impulsivity, decision making, and feedback utilization.

Procedure

For the study group, individuals diagnosed as having BPD by a psychiatrist, of psychiatry outdoor, following DSM-IV-TR criteria[20] were chosen. Total 22 individuals were approached for collecting data for the study group. However, the data of two individuals had to be rejected. One of the data was rejected as the subject was non-cooperative and unmotivated during the testing session and thus the validity of her data was questionable, while another data was rejected owing to drop-out. Finally, 20 individuals were retained in the study group. While for the comparative group, twenty individuals were approached for and data was collected on all of them. The procedure of administration of tests for both the groups is illustrated in (Fig. 1).

Ethical Considerations

The study was approved by the Institute of Postgraduate Medical Education and Research Institute of Postgraduate Medical Education and Research, Kolkata research oversight committee.

The participants were briefly explained about the purpose of the study and written Informed consent was obtained from each of the participants before the administration of the tests.

All information obtained from the participants was kept confidential and used only for research purposes.

RESULTS

Results of Sociodemographic Variables

Table 1 shows that the two groups did not differ significantly with respect to gender, occupation, family type, religion, and family income. However, the two groups differed significantly with respect to marital status,

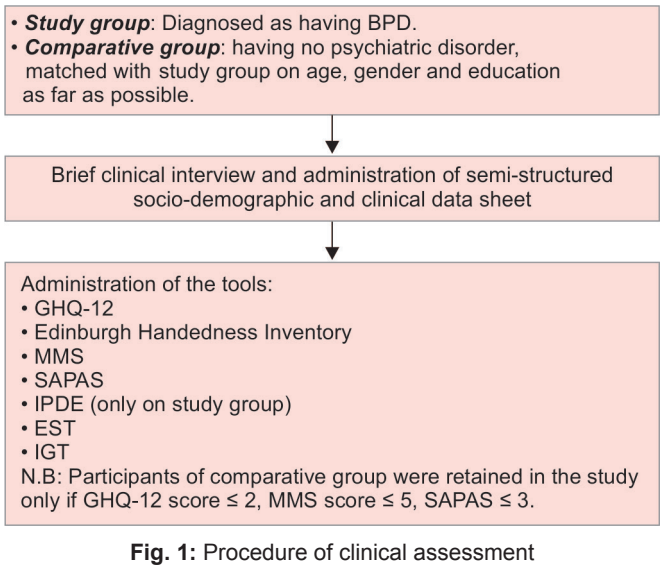

Fig. 1: Procedure of clinical assessment

wherein most of the comparative group participants were unmarried.

Table 2 shows that the two groups were found to differ significantly with respect to education with the study group having lesser years of education as compared to the comparative group.

Results of Study Variables

Table 3 shows that the two groups differed significantly with respect to the scores obtained on SAPAS, with the study group obtaining a greater score on SAPAS as compared to the comparative group.

Table 4 shows that the two groups differed significantly with respect to time taken on all three lists of EST, with the study group taking more time on all the three lists. Table 4 also shows that the performance of the two groups did not differ significantly GLF scoring of IGT, trial 81 to 100 and the total score of IGT, however the two groups differed significantly with for GLF scoring of IGT in trial 21 to 40, trial 41 to 60, and trial 61 to 80 with the study group performing significantly poorly for all three sets of trials.

Table 5 shows that, for the study group and the comparative group, the performance of the individuals differed significantly among emotional stroop test list containing negative words, a list containing neutral words and the list containing positive words.

Table 6 shows that the performance of the study group differed significantly between EST containing positive words and EST containing negative words, Table 6 also shows that the performance of the comparative group differed significantly between EST containing neutral words and EST containing negative words.

Table 1: Frequencies, percentages, Cochran's and Mantel–Haenszel values for the discrete variables across the study group and the comparative group

Variables	*Category*	*Study group (n = 20)*	*Comparative group (n = 20)*	*Chi-square and Mantel–Haenszel*
Gender	Male	2 (10%)	3 (15%)	0.00
	Female	18 (90%)	17 (85%)	
Marital status	Married	10 (50%)	1 (5%)	7.82**
	Unmarried	10 (50%)	19 (95%)	
Occupation	Employed	3 (15%)	5 (25%)	0.15
	Unemployed	17 (85%)	15 (75%)	
Family type	Nuclear	13 (65%)	14 (70%)	0.00
	Joint	7 (35%)	6 (30%)	
Religion	Hinduism	17 (85%)	15 (75%)	0.15
	Others	3 (15%)	5 (25%)	
Family income	Upto 25000	12 (60%)	7 (35%)	1.56
	>25001	8 (40%)	13 (65%)	

*p <0.05
**p <0.01

Table 2: Means, standard deviations (SD), and t-test values for continuous socio-demographic variables across the study group and the comparative group

	Study group (n = 20)		*Comparative group (n = 20)*		
Variable	Mean	SD	Mean	SD	*t-test value (df = 38)*
Age (in years)	23.10	5.13	23.05	2.5	0.04
Education (in years)	12.10	2.7	15.60	1.93	–4.70**

*p <0.05
**p <0.01

Table 3: Means, standard deviations (SD), and t-test for scores obtained on standardized assessment of personality-abbreviated scale (SAPAS)

	Study group (n = 20)		*Comparative group (n = 20)*		
Variable	Mean	SD	Mean	SD	*t-test value (df = 38)*
SAPAS score	5.85	1.35	1.00	0.79	13.86**

**p <0.01

Table 4: Results of the Mann–Whitney U test to compare the study group and comparative group for performance on emotional stroop test (EST) and Iowa gambling task (IGT)

	Study group (n = 20)			*Comparative group (n = 20)*				
Variable	*Mean*	*SD*	*Mean Rank*	*Mean*	*SD*	*Mean rank*	*Mann–Whitney U*	*p-value*
EST-negative words	15.45	6.93	27.65	9.1	2.27	13.35	57.000	0.000
EST-neutral words	13.25	3.48	28.08	8.55	2.06	12.92	48.500	0.000
EST-positive words	12.35	3.73	26.52	8.65	1.84	14.48	79.500	0.001
IGTGLF-trial 21–40	–1.30	4.41	15.00	2.70	4.07	26.00	90.000	0.002
IGTGLF-trial 41–60	0.90	6.069	16.78	4.40	4.38	24.22	125.500	0.043
IGTGLF-trial 61–80	–0.30	6.78	14.98	5.50	5.46	26.02	89.500	0.002
IGTGLF-trial 81–100	2.20	7.62	17.90	5.10	5.78	23.10	148.000	0.165
IGT-total	1772.5	567.36	23.55	1530	512.32	17.45	139.000	0.102

Table 5: Results of the Friedman test for the study group and comparative group to see within group performance on emotional stroop test (EST)

	Study group (n = 20)				*Comparative group (n = 20)*			
Variable	*Mean*	*SD*	*Freidman test value*	*p-value*	*Mean*	*SD*	*Freidman test value*	*p-value*
EST-negative words	15.45	6.93	11.313	0.003	9.1	2.27	6.520	0.38
EST-neutral words	13.25	3.48			8.55	2.06		
EST-positive words	12.35	3.73			8.65	1.84		

df = 2

Table 7 shows that for the study group the performance of the individuals did not differ significantly among the four sets of trials of IGT-GLF. However, for the comparative group, the performance of the individuals differed significantly among all four sets of trials of IGT- GLF.

Table 8 shows that the performance of the study group on Iowa IGT-GLF differed significantly in trials 21 to 40 versus trials 81 to 100 and in trials 61 to 80 versus trial 81 to 100. Table 10 also shows that the performance of the comparative group on IGT-GLF differed significantly in trials 21 to 40 versus trials 41 to 60 and in trials 21 to 40 versus trial 61 to 80.

Table 6: Results of Wilcoxon Signed Rank test for the study group and comparative group for performance on emotional stroop test (EST)

	Study group		*Comparative group*	
EST Variables	*Z value*	*p-value*	*Z value*	*p-value*
EST-negative words	15.45	6.93	9.1	2.27
EST-neutral words	13.25	3.48	8.55	2.06
EST-positive words	12.35	3.73	8.65	1.84

df= 2

DISCUSSION

Table 1 shows that the study group of our sample comprised of 10% males while there were 90% females. Literature also supports these findings wherein it is seen that about 75% of the cases diagnosed as BPD are females[30] and hence an over-representation of the female gender is expected. Table 1 also indicates that the two groups differed significantly with respect to marital status, indicating that the groups could not be matched with respect to marital status. However, marital status is not expected to interfere with the findings. Table 2 indicates that the two groups differed significantly with respect to education with the study group having lesser years of education as compared to the comparative group. However, no studies were found to indicate

Table 7: Results of the Friedman test for the study group and comparative group to see within group performance on IGT-GLF

	Study group (n = 20)				*Comparative group (n = 20)*			
Variable	*Mean*	*SD*	*Freidman test value*	*p-value*	*Mean*	*SD*	*Freidman test value*	*p-value*
IGTGLF-trial 21–40	–1.30	4.41	6.619	0.085	2.70	4.07	10.427	0.015
IGTGLF-trial 41–60	0.90	6.069			4.40	4.38		
IGTGLF-trial 61–80	–0.30	6.78			5.50	5.46		
IGTGLF-trial 81–100	2.20	7.62			5.10	5.78		

df = 2

Table 8: Results of Wilcoxon signed rank test for the study group and comparative group for performance on Iowa Gambling Task- Gain Loss Frequency.

	Study group		*Comparative group*	
EST Variables	*Z value*	*p-value*	*Z value*	*p-value*
IGTGLF-trial 21–40 v/s 41–60	–1.920	0.055	–2.054	0.040
IGTGLF-trial 21–40 v/s 61–80	–0.530	0.596	–2.080	0.037
IGTGLF-trial 21–40 v/s 81–100	–2.078	0.038	–1.744	0.081
IGTGLF-trial 41–60 v/s 61–80	–1.315	0.188	–0.817	0.414
IGTGLF-trial 41–60 v/s 81–100	–1.003	0.316	–0.877	0.380
IGTGLF-trial 61–80 v/s 81–100	–2.199	0.028	–0.655	0.513

df = 2

the relationship between education and various aspects of BPD.

It is evident from Table 4 that the study group has taken significantly more time in all the three lists of EST as compared to the comparative group. However, since the study group has taken significantly greater time even for the neutral-EST, it can be said that they have slow information processing, and an overall deficit in response inhibition which is also seen in other studies wherein individuals with BPD have been found to have difficulties in inhibiting a response that is relatively more potent.[8] Various studies have found Response Inhibition to be mostly a function of the dorsolateral prefrontal cortex, ventrolateral prefrontal cortex, and Orbitofrontal cortex.[31-34] Other brain areas that play an important role in response inhibition are the anterior cingulate cortex and parietal cortex.[34-36] Poor inhibitory control in individuals with BPD could be due to deficits or hypoactivity in these brain areas which has also been confirmed by various studies. Various neurobiological studies on BPD have indeed found reduced volumes in frontal regions,[37] such as the orbitofrontal cortex, the dorsolateral prefrontal cortex, and the anterior cingulated cortex.[38] A study by Morandotti in 2013 showed a reduction in the volume of ventrolateral prefrontal cortex in BPD patients with a history of childhood sexual abuse,[39] while a study by Irle in 2007 shows reduced volume in the superior parietal cortex in individuals with BPD.[40] In the present study, the EST not only shows an overall deficit in response inhibition in individuals with BPD, but it also shows their attentional bias towards negative stimuli as compared to positive stimuli (Table 6). The amygdala is considered to play an important role in the processing of negative emotions,[41] and studies suggest that in individuals with BPD the amygdala was seen to have greater and prolonged activation in response to negative stimuli.[42-43] On the contrary, a number of authors have drawn attention to the reduced amygdala volume, yet hyperactivity in the amygdala's responses in BPD patients, when confronted with emotion-related stimuli.[44-46] The heightened sensitivity to negative emotion in individuals with BPD could be considered as stemming from abnormalities of this sort.

The findings on the paradigms of IGT reveal deficient decision making and poor feedback utilization in the BPD individuals of the study group. These paradigms are controlled by the Orbital Frontel Cortex (OFC) and studies suggest that the lateral OFC is activated during a punishing outcome while the medial OFC gets activated during a rewarding outcome[47]. As mentioned earlier, various studies have shown reduced OFC volume[38] in individuals with BPD which could be responsible for their deficient processing of reward and punishment, hence leading to poor decision making and poor feedback utilization. Their deficits in decision making and feedback utilization could also be partially be explained by their impulsivity which is once again owing to impairment in OFC which plays a major role in top-down inhibitory control via "reverse-learning"—where maladaptive impulses and choices are suppressed in favor of more adaptive/socially appropriate choices.[48-49] These neuropsychological deficits seen in individuals with BPD are also manifested in their daily lives in various forms. For instance, individuals with BPD are unable to inhibit behavioral responses that are inappropriate in a given context, and the ability to inhibit behavior as and when required is an important component of an individual's functioning and adjustment. The deficit to inhibit behavioral responses is manifested in the form of impulsivity which does form a core feature in BPD.[20]

Along with impulsivity, and poor inhibitory control, individuals with BPD also have an attentional bias towards negative stimuli owing to which they may have difficulties disengaging from threatening stimuli, and their ability to focus attention on additional information relevant to safety and relief may be limited.[50] Scanning one's environment for threat-related information does have a survival value, but unnecessary attention to stimuli that are not threatening can be maladaptive as it can lead inappropriately high levels of arousal which may eventually interfere with one's daily functioning. Their heightened sensitivity to negative

emotions can thus lead to social disturbances: particularly, the tendency in borderline patients to become too angry too quickly in interpersonal situations which others can handle more calmly.[51]

Although not well studied, decision-making and feedback utilization deficits in BPD have been described as inadequate planning of future options, a disregard of negative consequences, a hypersensitivity to reward and inability to delay gratification.[52]

Individuals with BPD more often than not manifest risky and potentially self-damaging behaviors without considering what the consequences could be and these risky choices are not just influenced by the poor decision-making ability and impulsivity but also by their excessive sensitivity to emotional stimuli. Emotion is considered to influence decision making even in normal individuals[53] and in individuals with BPD emotional dysregulation is as it is a key feature[7] which does affect their decision-making ability.

CONCLUSION

This study highlights the role of various neuropsychological deficits in BPD. The understanding of these processes such as deficient response inhibition, attentional bias towards negative stimuli, impulsivity in decision making and poor feedback utilization not only give an insight into the psychopathology of this disorder but also fit very well with the neurobiological deficits. Not only are these findings important in gaining a better and deeper understanding of this disorder, but shall also prove helpful in planning the treatment of these individuals keeping in mind their dispositions.

LIMITATIONS AND FUTURE DIRECTIONS

It is obvious that the more the number of subjects investigated, the greater is the scope for generalization of the findings. Further research may be done with a larger sample size. This would make the findings easier to be generalized.

The study group was selected only from the OPD of a government hospital and not from the community at large. Individuals having BPD can also be screened and selected from the community. This would also make it easier to generalize the findings.

A larger array of neuropsychological tests can be employed to get a wider measure of a variety of executive functions in BPD.

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