Original Article

Neuro-Cognition in Adolescents with Dissociative Disorder: A Study from a Tertiary Care Center of North India

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ABSTRACT

Background: Dissociative disorder is a common neurotic disorder. Patients with dissociative disorder experience significant psychological distress and have deficits in various domains of neurocognitive functions. **Objective:** To assess the neurocognitive functioning of adolescents diagnosed with dissociative disorder and compare it with that of healthy controls. **Materials and Methods:** This is a cross-sectional observational study conducted on adolescents diagnosed with dissociative disorder, attending child and adolescent specialty clinic of a tertiary care hospital of North India from October 2016 to February 2017. Healthy control subjects were also recruited for comparison on study variables. Malin's Intelligence Scale for Indian children and standardized neuropsychological tools were administered for the assessment of intellectual functioning and neurocognitive functioning. **Results:** A total of 50 participants with dissociative disorder and 50 healthy controls completed the study. Participants of both the groups had an average level of intellectual functioning. Participants with dissociative disorder showed poorer performance on tasks of attention and executive functions. After the Bonferroni correction, deficits were detected in the domains of coding ($P = 0.0012$), maze ($P = 0.0001$), and mathematics ($P = 0.0016$). **Conclusions:** Adolescents with dissociative disorder have impaired neurocognitive functions in comparison to healthy controls.

Key words: *Adolescents, dissociative disorder, neuro-cognition*

Key messages: *a) Adolescents with dissociative disorder have deficits of certain neurocognitive functions in comparison to healthy control. b) Though the overall intellectual functioning of patients with dissociative disorder are comparable with that of healthy controls, significant deficits remain in the domains of coding, arithmetic, and maze task.*

The recently conducted National Mental Health Survey (2015–16) had revealed, in a community representative population, the prevalence of mental morbidity in adolescents aged between 13 and 17 years to be 7.3% in India.[1] The proportion of patients diagnosed with dissociative disorders in India ranged between 1.5–15.0 per 1000 outpatients and between 1.5–11.6

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per 1000 inpatients. The prevalence rate of dissociative disorder in child and adolescent group in India has been reported to be 12.5%.[2]

Several studies have focused on the psychosocial variables related to patients suffering from dissociative disorder.[3-6] The cognitive aspect of dissociative disorder is less understood. Recent studies have focused on the functional connectivity between the brain regions involved in emotion processing and those involved in representing sensory information, which may be enhanced, generating unusual motor sensory symptoms in the context of stress.[4,7,8]

A century ago, Janet (1919) was the first to conceptualize dissociative symptoms as having a neurocognitive component – in particular, as disorders of memory processing that arise in the wake of trauma. Later, neurobiological models pointed to deficits in both memory and attention and postulated that these deficits would be more prominent during the presence of symptoms and during testing conditions that were stressful or that provoked anxiety.[9,10]

The importance of intelligence in the genesis of neurotic illness has been reported in the literature.[11-13] The intellectual functioning of patients with dissociative disorders has been studied, but the results are very inconsistent, as some studies report average intellectual functioning in dissociative disorders, whereas some other studies report decreased baseline intellectual quotient or presence of scatters on intellectual testing.[14-16] The presence of scatter on intelligence subtests indicates the presence of neurocognitive deficits which may be an important causal factor of dissociation. Studies on neurocognition in dissociative disorder had also showed mixed results. An Indian study conducted by Ranjan *et al*., (2016) on a sample of child and adolescent patients (8–16 years) suffering from dissociative disorder revealed the presence of significant deficits in the areas of visuoconstructive and visual organization abilities, verbal working memory, executive functioning, learning, and attention.[16] In another study in children and adolescents with conversion disorder, a similar pattern of neurocognitive deficits was found.[15]

Evidence suggests that children and adolescents with various subtypes of dissociative disorders exhibit impairments in spatial working memory, planning and organization, attention, verbal memory and naming tests, as well as decreased performance on tasks of visual memory and immediate memory.[17-19]

Most of the existing literature on patients with dissociative disorders are on the adult population. The evidence regarding the neurocognitive functioning in children and adolescents are inconclusive and inconsistent. We hypothesize that adolescents with dissociative disorder have deficits in neurocognitive functions (learning, memory, intelligence, visuospatial abilities, attention and concentration, and executive function) compared to healthy counterparts. The recent study of Ranjan *et al*., (2016) assessed neuropsychological functioning of children and adolescents with dissociative disorder.[16] But the study did not include a comparison with healthy controls. We adopted the concept of the above-mentioned study and aimed to assess the neurocognitive function of adolescent patients presenting with dissociative disorders and compared it with healthy controls.

MATERIALS AND METHODS

It is a cross-sectional observational study conducted in a tertiary care center of North India. The sample consisted of 50 adolescents aged between 10–16 years, with a diagnosis of dissociative disorder, and 50 age, gender, and education-matched healthy controls. It is a time-bound study of 5 months. The patients with dissociative disorder were recruited from the child and adolescent psychiatry clinic of a tertiary care hospital of North India. The diagnosis of dissociative disorder, consistent with ICD-10 criteria, was made by the consultant psychiatrist. Participants who were able to read and write as well as not having visual, speech, or hearing impairments were included in the study. Those with medical illnesses involving the central nervous system and those with mental retardation, indicated by clinical history and developmental milestones, were excluded.

Healthy controls (age, gender, and education-matched) were recruited from healthy siblings/relatives of non-psychotic, non-attention deficit hyperactivity disorder (ADHD), and non-autistic patients attending the psychiatry child and adolescent outpatient services in the same institute. They were healthy siblings of patients with either dissociative/conversion disorder, depression, or adjustment disorder. We adopted the selection criteria and domains of neuropsychological assessment from the study of Ranjan *et al*., (2016).[16]

Tools used for assessment

1. **Malin's Intelligence Scale for Indian Children (MISIC)**[20]**:** The battery comprises of 11 tests viz, information, comprehension, similarities, digit span, arithmetic, vocabulary, picture completion, object assembly, mazes, coding, and block design. Assessment on MISIC, three different types of scores were generated i.e., verbal quotient (VQ), performance quotient (PQ), and full-scale IQ. VQ

included information, comprehension, vocabulary, as well as the understanding of abstract. PQ included working memory, attention, planning and problem solving as well as visuospatial processing especially in the areas of attention, working memory, and planning and problem solving

2. **NIMHANS neuropsychological battery**[21] **(selective subtests):** The battery is a description of neuropsychological tests in current usage internationally as well as their mode of administration and normative data for Indian subjects' neuropsychological functioning in a comprehensive manner. For the purpose of the present study, selective subtests were opted. The tests selected from the battery were – Wisconsin Card Sorting Test (set-shifting ability), Stroop Test (response inhibition), and Rey's Auditory Verbal Learning Test (learning and memory).

Procedure

The study was conducted from October 2016 to February 2017, after getting ethical clearance from the institutional ethics committee. Patients and controls were recruited as per the selection criteria. Written informed consent and assent were sought from the legal guardians of the participants and all the participants included in the study, respectively. Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID) 6.0 version was applied to rule out the presence of any comorbid psychiatric disorder. Sociodemographic and clinical details and neurocognitive functioning of the subjects of both the groups were assessed using the above tools. At the time of assessment, participants with dissociative disorder were stable. Neuropsychological assessments were completed soon after the clinical assessment. To minimize the drug effect on neurocognitive functioning, efforts were taken to administer the test at least 6 h after the last dose of medication.

Data analysis

Data were obtained using the Microsoft Excel 2007 software. Statistical analysis was performed on the SPSS version-16.0. Student's independent *t*-tests were used to compare scores of intellectual functioning and neurocognition between the experimental and the control groups. As multiple tests were applied, Bonferroni correction was used, and *P* value at 0.004 (0.05/14) was considered significant.

RESULTS

The sample was drawn from 86 consecutive referrals of children presenting with dissociative disorder. Out of 86, only 50 (33 girls and 17 boys) fulfilled the selection criteria and were included in the study. Most of the subjects were females (66%). The mean ± SD age of patients with dissociative disorder (13.3 ± 1.54 years) and control group (13.57 ± 1.31 years) were comparable. Most of the participants were belonging to the urban background (60% of the patients with dissociative disorder and 58% of control group) and were studying in 9th–10th standard. Most of the subjects were Muslims (62% in the patients with dissociative disorder and 64% in the control group), living in joint families, and with monthly family income between Rs. 10,000–20,000. The patients with dissociative disorder and the control group belonged to a comparable sociodemographic background [Table 1].

The mean duration of the current dissociative episode was 15.48 ± 8.63 days. Among the study population, 66% had mixed dissociative disorder, 18% had dissociative convulsions, 10% had dissociative stupor, and 6% had trance and possession disorder.

Assessment on Malin's Intelligence Scale for Indian Children

Patients with dissociative disorder and control group had comparable intellectual functioning in all the domains except performance quotient (t = 2.48, P = 0.0149). However, it was insignificant after applying the Bonferroni correction [Table 2].

Neurocognitive battery

Subjects of the patients with dissociative disorder showed difficulty related to attention as evident on the subtest of coding (t = 3.31, P = 0.001). The patients with dissociative disorder (92.22 ± 6.38)

Table 1: Sociodemographic profile of the participants

Parameters	Study group, *n*=50	Control group, *n*=50
Age (in years)	13.32 (±1.54)	13.57 (±1.31)
Gender		
Female	33 (66%)	33 (66%)
Male	17 (34%)	17 (34%)
Education		
Upto class 5th standard	5 (10%)	3 (6%)
6th-8th standard	18 (36%)	19 (38%)
9th-10th standard	27 (54%)	28 (56%)
Domicile		
Urban	30 (60%)	29 (58%)
Rural	20 (40%)	21 (42%)
Religion		
Muslim	31 (62%)	32 (64%)
Hindu	19 (38%)	18 (36%)
Monthly income (in INR)		
Upto 10,000	11 (22%)	6 (12%)
Between 10,000-20,000	27 (25%)	30 (60%)
Above 20,000	12 (24%)	14 (28%)

had significantly lower scores (t = 3.406, P = 0.001) on the subtest of attention (coding) as compared to the control group (95.59 ± 2.87). The patients with dissociative disorder as compared to the control group performed poorly on both the tests of working memory i.e., Digit Span Test (t = 2.19, P = 0.030) and mathematics (t = 3.24, P = 0.002). Compared to the control group, the patients with dissociative disorder was found to have poorer performance in subtest of similarities (t = 2.13, P = 0.035) as well as on the WCST (total correct response, P = 0.018; non-perseveratory errors, P = 0.012). Subjects of the patients with dissociative disorder showed decreased planning and problem-solving capacity (maze) (t = 4, P = 0.0001) as compared to the control group [Table 3].

After applying the Bonferroni correction, a significant difference persisted only in the domains of coding (P = 0.001), maze (0.0001), and mathematics (P = 0.002). Other domains that were found significant after applying the t-test were nullified after application of Bonferroni correction.

DISCUSSION

In our study, the patients with dissociative disorder and the control group belonged to a comparable sociodemographic background; hence the influence of sociodemographic variables on the study outcome is unlikely.

Both the groups had an average level of intelligence. There are differences in verbal as well as performance quotient among the study population (study and control group), which were non-significant after Bonferroni correction. The presence of scatter in attainment on subtests of intelligence battery indicates significant neurocognitive deficits in certain areas in these patients. Previous studies also found that patients with dissociative disorder had an average level of intellectual functioning and significantly lower performance intelligence as compared to verbal intelligence.[15,16]

In the present study, among neurocognitive tests, compared to the healthy controls, the subjects with dissociative disorder had impairment in the areas of attention, understanding of an abstract concept, and some aspects of executive functioning i.e., working memory, planning and problem solving, and set shifting ability. However, other neurocognitive areas like response inhibition ability, learning, memory, comprehension, visuospatial skills, and vocabulary were not different significantly among patients with dissociative disorder and healthy controls.

Table 2: Comparison of experimental and control groups on verbal, performance, and full 78-scale intelligence quotient

Domains of intelligence	Study group	Control group	*P*
Verbal quotient (VQ)	92.79 (3.29)	93.31 (2.90)	0.413
Performance quotient (PQ)	92.71 (3.01)	94.14 (2.64)	0.015
Full-scale IQ	92.73 (2.53)	93.64 (2.22)	0.064

Bonferroni correction value (α/n) = (0.05/14) = 0.00357, All the *P* values are non-significant as they are>0.004 after Bonferroni correction. VQ: Verbal quotient; PQ: Performance quotient; IQ: Intelligence quotient

Table 3: Comparison of experimental and control groups on MISIC subtests, WCST parameters, RAVLT, and stroop test

	Study group	Control group	*P*
MISIC subtest parameters			
Information	92.60 (4.69)	93.28 (3.48)	0.42
Comprehension	94.57 (7.72)	94.78 (3.31)	0.86
Mathematics	90.22 (4.01)	92.87 (4.05)	0.002**
Vocabulary	93.32 (5.32)	93.86 (3.26)	0.59
Digit Span	92.00 (3.51)	93.51 (3.22)	0.030*
Similarities	91.38 (3.91)	92.85 (2.71)	0.035*
Picture completion	92.62 (6.04)	93.65 (2.76)	0.283
Object assembly	92.32 (7.42)	93.85 (3.81)	0.209
Block design	92.96 (3.10)	93.95 (5.77)	0.288
Maze	92.02 (3.98)	94.95 (3.15)	0.0001**
Coding	92.22 (6.38)	95.59 (2.87)	0.001**
WCST parameters			
Total correct response	100.78 (6.75)	104.32 (7.69)	0.018*
Perseveratory errors	11.22 (6.81)	10.74 (6.60)	0.728
Non-perseveratory errors	16.00 (6.60)	12.85 (5.15)	0.012*
Conceptual level response	78.26 (13.37)	83.14 (11.84)	0.060
Failure to maintain set	1.88 (2.09)	1.14 (1.74)	0.065
Learning to learn score	2.37 (6.20)	0.93 (2.73)	0.146
RAVLT total learning score	39.30 (9.10)	42.27 (6.62)	0.07
RAVLT delayed recall score	7.60 (2.40)	8.44 (2.38)	0.085
Stroop effect	20.37 (7.88)	18.42 (7.15)	0.20

MISIC: Malin's Intelligence Scale for Indian Children; WCST: Wisconsin Card Sorting Test; RAVLT: Rey's Auditory Verbal Learning Test, Bonferroni correction value (α/n) = (0.05/23) = 0.003, *Non-significant as it is >0.003 after Bonferroni correction, **Significant, as it is <0.003 after Bonferroni correction

Each of the neurocognitive tasks on which dissociative disorder subjects performed poorly is dependent on adequate prefrontal cortical functioning.[22] It suggests that the pattern of cognitive difficulties shown by participants with dissociative symptoms is consistent with a disorder of cognitive control. The present study specifically focused on the adolescent population, and no significant deficits were found in visuoconstructive and visual organization abilities in the present study.

The construct of cognitive control is understood as comprising a number of partially independent functions, including proper allocation of attentional resources (measured here by coding Attention Test), conflict monitoring (WCST), response inhibition (Stroop

test), working memory (Digit Span Test, Coding), and planning and problem solving ability (maze test). The decreased working memory capacity on multiple subtests of the Digit Span Test and Coding test showed a clear deficit in the cognitive component of prefrontal cortex (PFC) function. The increased number of errors on WCST highlights the participants' difficulties in blocking interfering information throughout these domains. After Bonferroni correction, significant differences remained on the domains of mathematics, maze, and coding; however, no significant difference was found in any of the parameters of WCST, indicating the need for further research in a larger population to assess the differences in cognitive parameters. With certainty, it can be said that patients with dissociative disorder have deficits in certain parameters of neuropsychological functioning, which may be taken as soft signs or cognitive markers. Tax the resources.

The function of the PFC is to utilize the limited resources to maintain an effective balance between cognition and emotional processing.[23] The interaction between cognitive function (executive function) and emotion regulation in the PFC reflects the intactness of functional connectivity of PFC with amygdala. The above interaction is a complex process, where the emotional stimuli are processed which in turn influence the cognitive performance. This interaction process in the PFC is mediated through allocation of resources. In situations where there is an increased demand (pressure to perform), resources may get depleted and imbalance may happen in cognitive and emotional control (due to poor allocation of resources to PFC for cognitive control).[24] Hence, cognitive control is implemented by the PFC and it functions to override emotional or habitual responses to stimuli.[24] Our cohort of adolescents with dissociative disorder showed decreased performance in the above-mentioned areas. As all of the above tasks involve the PFC, a shift in the balance between cognitive/integrative processing and emotion/motor-sensory processing secondary to long-term stress will compromise individuals' cognitive/integrative capacities. These findings are consistent with earlier studies which found the presence of deficits in attention, working memory, set shifting ability, as well as planning and problem solving in subjects with dissociative disorder as compared to healthy controls.[15,16]

In this study, out of the 50 adolescents with dissociative disorders, none had a comorbid brain disease, and testing was completed soon after the presentation when the patients were receiving a low dosage of medication. In addition, patients with developmental delay were excluded, and the participants with dissociative disorders and control group were comparable in terms of their IQ. This was crucial, as multiple developmental pathways and several factors related to brain disorders that can potentially affect neurocognitive function in patients with dissociative disorder, like brain disorders (for instance, developmental delay, epilepsy, and other neurological abnormalities), childhood maltreatment, psychotropic medications, and medications for the treatment of comorbid epilepsy, had a relatively minor presence in this study. Thus, it is unlikely that they would have affected the performance of the patients with dissociative disorder as compared to the control group on these neuropsychological tests.

The present study highlights that mechanisms underpinning dissociative symptoms can be activated in what is, neurologically, a healthy brain. Thus, although brain disease may potentially be a risk factor for dissociative disorders, it cannot be considered as either a necessary or sufficient condition for their development. Adolescents with dissociative disorder have compromised PFC functions that mediate cognitive/integrative processing. This finding has important implications for therapy. The clinicians may assess the neurocognitive functioning of adolescents with dissociative disorder as it is the formative age during which the development of neurocognitive functions occurs.

Limitations

Small sample size and narrow age range selection limit the generalizability of the study findings. Though the patients were receiving very low doses of psychotropic medications (benzodiazepines or antidepressants), their effect on neurocognitive function could not be ruled out. Future studies could address these shortcomings by replicating the study on a bigger sample with a broader age range, to make the findings more generalizable. All subtypes of dissociative disorder were clubbed together due to the small sample in each subgroup. The diversity of neurocognitive dysfunction among these subgroups cannot be ruled out. The dissociative psychopathology among the patients was not quantified and hence not correlated with the neurocognitive deficits. Additionally, it would be worthwhile looking at the neuro-cognitive symptoms of patients with dissociative disorder in the remission phase. Healthy controls were healthy siblings/relatives of patients with depression, dissociative disorder, or adjustment disorder, which may limit the generalizability of the study. Choosing healthy controls from natural settings with no family members affected with psychiatric disorder might increase the generalizability of the findings. No structured screening tool was used, which is another limitation of the study.

CONCLUSION

Adolescents with dissociative disorder have obvious neurocognitive deficits compared to their healthy counterparts. Understanding the pattern of neuropsychological deficits will help in understanding the disorder from the perspective of neuropsychology. It may guide the clinician for understanding the etiopathogenesis of the disorder as well as planning the therapeutic intervention.

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Conflicts of interest

There are no conflicts of interest.

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