

Correlation between Psychopathology and Intellectual Performance in Boys with Attention Deficit Hyperactivity Disorder

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Abstract: Epidemiological studies suggest that Attention Deficit Hyperactivity Disorder (ADHD) is one of the most significant and common externalizing disorder which occur more among boys. The current study aims to see the relationship between intellectual functioning and behavioral and social problems in ADHD and non-clinical control group. Purposive sampling was done. 20 males between 6-14 years of age with ADHD were compared with 20 males with no significant psychopathology. Wechsler Intelligence Scale for Children IV India and Conner's III Parent's Form was used to assess the same. Obtained data was statistically analyzed using Mann Whitney U Test and Spearman Correlation Test. Mann Whitney U test revealed significant difference in the two groups in terms of behavioral problems and intellectual functioning in most variables. Significant negative correlation was found in intellectual functioning and externalizing problems which include inattention, hyperactivity and defiance. This study has an implicative value and would be useful in formulating evaluation and intervention strategies.

Key Words: ADHD, Intelligence, executive functioning, behavioural problems

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I. INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common childhood externalizing disorders and its symptoms become more apparent in the preschool and early school years. Epidemiological studies have suggested an increase in the number of diagnosed ADHD cases. ADHD occurs in approximately 4-12% of children between the ages of 6 and 12 years (6.7) with 10-20% in India¹. There is a significant discrepancy in the prevalence of ADHD between the males and the females, the ratio being 3:1.

Some of the co-morbidities associated with ADHD are poor academic performance, behavioral difficulty, learning difficulty and interpersonal difficulties. Behavioral difficulties were found in 36.11% of the children with ADHD.

Research studies reveal a significant positive correlation between intelligence quotient and ADHD features. It has been observed that children with ADHD receive frequent complaint from school about academic difficulties². Further the teachers have observed that 19.44% of the ADHD children tend to be sufficiently disturbed to seek psychiatric guidance³. Literature has suggested that children with ADHD presentations exhibit slower processing speed and significantly worse verbal comprehension and perceptual reasoning⁴. Poor academic performance consequently results in features of depression, anxiety and negative self concept. Further investigation is required to determine the extent to which these profiles can predict academic, social and behavioral outcomes. Thus, the current study attempts to see the cognitive domains of ADHD children and how it consequently affects the externalizing problem.

II. MATERIALS & METHODS

This cross-sectional comparative study was carried out on patients of a private mental health clinic, Caring Minds, Kolkata, West Bengal from August 2016 to October 2016. A total 40 male subjects between the ages of 6-14 years were included in this study.

Study Design: Cross-sectional comparative exploratory study

Study Location: This was a multi-specialty mental health clinic based in Kolkata, West Bengal.

Study Duration: August 2016 to October 2016.

Sample size: 40 subjects (20 clinical and 20 control).

Subjects & selection method: The clinical group consisted of 20 boys who met the ICD 10- DCR of F90.0 Hyperkinetic Disorder, Disturbance of activity and (M = 10.45. SD = 3.12). From within the community 20 boys with no psychiatric or physical symptoms were included in a non clinical control group through matching in terms of age, SES and educational background (M = 11.32. SD = 3.29).

Inclusion criteria:

1. Only male subjects
2. Boys between the ages 6-14 years
3. IQ above 80 in Wechsler Intelligence Scale for Children India-IV
4. Scores above 60 in the inattention and hyperactivity domain in Conners 3 (Parent form) (For clinical group)
5. Scores below 55 in the inattention and hyperactivity domain in Conners 3 (Parent form) (For control group)
6. Middle and upper socio-economic status according to Kuppuswamy's Socio-economic Status Scale
7. No history of separation between parents

Exclusion criteria:

1. Family history of mental illness in three generations
2. No psychiatric co-morbidity in clinical group
3. No history of mental illness in control group
4. No known history of physical or sexual abuse

Tools

The clinical tools which were included in the present study are as follows:

Wechsler Intelligence Scale for Children IV India ⁵: It is a comprehensive measure of a child's abilities and weaknesses that are strongly correlated with the child's academic difficulties in varied areas. The four broad areas assessed include verbal comprehension, perceptual reasoning, working memory and processing speed. The internal consistency coefficient for the full scale ranges from .88 to .97, along with high external validity.

Conner's III Parent's Form ⁶, is a multi-informant assessment of children and adolescents between 6 & 18years of age that takes into account home, school and social settings. The Conners III features multiple scales that assess not only ADHD but also related problems in executive function, learning problems, defiance, aggression and peer-family relations. Internal consistency is between .77 to .97, four week test-retest reliability coefficient ranges from .70 to .98 and inter-rater reliability coefficients range from .52 to .94. Convergent and divergent validity is high.

Kuppuswamy's Socio-economic status scale: ⁷ This scale is based on a composite score considering the education and occupation of the head of the family along with monthly income of the family, which yields a score of 3-29. This scale classifies the study participants into high middle and low socio-economic status.

Procedure methodology

For the clinical group the children coming to the clinic were screened through an interview and by administering the Conner's III Parent's form. Children who scored below 55 in the inattention and hyperactivity domain were included in the control group and the children who scored above 60 were included in the clinical group in the current study. For both the clinical and control group, intelligence quotient (IQ) was assessed using the WISC IV India and those who obtained a full scale IQ 80 or above were included in the study.

Statistical analysis

Data was analyzed using SPSS version 16. The Mann-Whitney U was used to ascertain the significance of differences between mean values of two continuous variables. Spearman's Rank Correlation was used to measure the relationship between the dependent variables. The level $P < 0.05$ was considered as the cutoff value or significance.

III. RESULTS

Table no 1: Comparison between the two groups in terms of intellectual functioning.

Variables	Group	Mean rank	Sum of ranks	Mann Whitney U	Sig.
Verbal Comprehension	ADHD	17.75	355.00	145.000	.135
	Control	23.25	465.00		
Perceptual Reasoning	ADHD	10.80	216.00	6.000	.008
	Control	30.20	604.00		
Working Memory	ADHD	15.58	508.50	101.500	.000

	Control	25.42	237.50		
Processing Speed	ADHD	11.88	237.50	27.500	.000
	Control	29.12	582.50		
FSIQ	ADHD	14.02	280.50	70.500	.000
	Control	26.98	539.50		

Results indicate significant difference in the two groups in terms of perceptual reasoning, working memory and processing speed. All three executive functions are lower in children with ADHD as compared to normal control group.

Table no 2: Comparison between the two groups in terms of behavioural problems.

Variables	Group	Mean rank	Sum of ranks	Mann Whitney U	Sig.
Learning Problems	ADHD	30.05	601.00	9.000	.000
	Control	10.95	219.00		
Executive Function	ADHD	30.50	610.00	0.000	.000
	Control	10.50	210.00		
Defiance	ADHD	29.60	592.00	18.000	.000
	Control	11.40	228.00		
Peer Relation	ADHD	27.35	547.00	63.000	.000
	Control	13.65	273.00		

Results indicate significant difference in all the variables between the two groups. All functions are adversely affected in ADHD children.

Table 3: Correlation between intellectual functioning and behavioural problems.

		Inattention	Hyperactivity	Learning Problem	Executive Function	Defiance	Peer Relation
VCI	r _s	- 0.122	-0.273	-0.474	-0.209	.255	.315
	P	.608	.245	.35	.377	.277	.176
PRI	r _s	-.122	.157	.119	.188	.125	.143
	P	.609	.508	.616	.428	.600	.549
WMI	r _s	.030	-.153	.061	.089	.265	-.070
	p	.901	.520	.797	.709	.260	.771
PSI	r _s	-.304	-.480	-0.267	-0.172	-.236	-.332
	p	.193	.032	.255	.468	.316	.153
FSIQ	r _s	-.159	-.394	-0.407	-.258	-.213	.033
	p	.504	.086	.075	.272	.366	.890

Significant negative correlation (rs= -.480, p= .032) was found between processing speed and hyperactivity.

IV. DISCUSSION

The study purports to assess the relationship between intellectual performance and behavioral problems in children with ADHD. They exhibit a number of academic and behavioral abnormalities which may result from the symptoms of the disorder itself. Intellectual assessment has been useful in characterizing the cognitive deficits demonstrated by these children for both assessment and intervention purpose. From academic perspective results can be successfully used to develop educational assistance, plans and intervention methods to improve the measures.

Mann- Whitney U test results indicate significant difference in the ADHD and the control groups in terms of perceptual reasoning, working memory and processing speed. All three executive functions are lower in children with ADHD as compared to normal control group.

Low perceptual reasoning in working memory may be due to the lack of behavioural inhibition in the ADHD population. Neurobiological studies suggest deficit in frontal lobe which may affect inhibition.

Processing speed and working memory indicates difficulties in storage of information in the short term memory and manipulation of this information as well as quick performance of simple clerical task ⁸. In children with ADHD, the pre-frontal cortex ⁹, caudate nucleus ¹⁰ and Primary motor cortex ¹¹ functioning are severely affected. These brain dysfunctions may affect working memory and processing speed as indicated in the study.

Further, inattentive symptomatology may also contribute to and has been assumed to underlie the reward and motivational deficits observed in ADHD the problem.

Table 2 indicates significant difference in all the psychological variables between the two groups. All functions are adversely affected in ADHD children. Various research studies have put forward the evidence of several developmental pathways being indicated in ADHD. The link between inattention and executive function deficits to prefrontal-striatal circuit's impairment has been suggested by the dual pathway model of ADHD¹². This model further suggests that hyperactivity may result from the dysfunctions of reward response and motivation, related to a frontal-limbic system. Abnormal behavior change which is a characteristic feature of reward-motivation deficits, usually takes place after the application of reward and punishment. The mesoaccumbens dopamine pathway is involved in reward and motivation process^{13,14}. During the processing of reward in ADHD children decreased nucleus accumbens activation has been observed in the recent functional magnetic resonance imaging (fMRI) studies^{15,16}.

Another pathway indicated in ADHD is the multiple pathways. It implicates that poor behavioral adjustment to environmental cues may be caused because of ineffective signaling of the prefrontal cortex by subcortical and posterior systems or in other words a failure to detect the differences between the current and expected context, resulting from failure in bottom-up mechanisms. It may also occur as a result of failure of the top-down control¹⁷.

It can further be further elaborated that the "Top-down" or controlled processes indicate effortlessly pursuing a goal directed behavior, whereas "bottom-up" processes indicate one's quick reaction to stimulation¹⁸. Thus, significant roles are played by the "top-down" and "bottom-up" processes in the etiology of ADHD. The inattention symptoms can be specifically explained by the "top-down" processes and impulsivity/hyperactivity can be specifically explained by the "bottom-up" processes.

Results also suggested deficit in learning problems. This can be explained with the cognitive level of hypothesis¹⁹. It suggests that in ADHD children the difficulties in learning skills may become automatic, that it does no longer need explicit attentive control. Deficit in three stage analysis was done suggesting learning problems:

Initial declarative stage: What to do is learnt.

Intermediate procedural stage: How to do it is worked out

Final autonomous stage: Skills become fluent and automatic.

Negative correlation was found between processing speed and hyperactivity can be explained by Premotor circuits are associated with slower processing speed in ADHD²⁰.

The present study finding yield implications for assessment and intervention efforts. Study gives an insight into executive functions as well as behavioural problems in ADHD children which in turn may assist to plan intervention strategies to prevent the development of psychopathology. We also attempted to see the relationship between intellectual functioning and behavioural problems. It was observed that there was no significant difference in the verbal comprehension scores between the two groups hence verbal tasks can be effectively used in the intervention.

Though study is useful for academic intervention of children with ADHD, it is not free of certain limitations. The study consisted of 40 individuals, 20 in each group. However, a larger sample could have yielded more information, thereby enriching the study and increasing generalizability. The study entailed patient from only one clinic, thus leading to problems in generalizability and external validity. Rating Scale was used in the study which automatically included the self-reporting biases along with the possibility of some faking. Females were not included in the study which limits the application of the study.

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