Original Article

Verbal Learning & Memory Function among Children with ADHD and Emotional Disorders

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ABSTRACT

Memory function and learning process are commonly observed impaired among children with Attention Deficit Hyperactive Disorder (ADHD). However, children with Emotional Disorders (ED) too report inability to attend, register and recall the stimuli that eventually result in poor academic performance. The present study aimed to study the nature of impairment in verbal learning and memory function among children with ADHD and ED. The study further aimed to explore the effect of severity of illnesses over the degree of impairment in verbal learning and memory function in both the groups. Twenty children meeting the ICD-10 criteria for ADHD and twenty children meeting the ICD-10 criteria under F-93 for Emotional Disorders (ED) were assessed on the measure of verbal learning & memory and compared with twenty age and education matched normal control group. Children with ADHD and ED performed poorly on the measure of verbal learning and memory in comparison of normal control, but the degree of impairment was observed relatively higher among ADHD children than children with ED. However, severity of illness was not observed a contributory factor for the impairment in verbal learning and memory function in both the groups. Impairment in verbal learning and memory function is not confined only to the children with ADHD but these are now recognizable among children with Emotional Disorders too. Both the groups (Children with ADHD and ED) reflected impaired memory and learning function but in terms of degree of impairment the children with ADHD were always found standing towards higher side than children with emotional disorder.

Key Words: Verbal Learning, Memory, ADHD, Emotional Disorder

Introduction

Over the decades the extensive researches and clinical experiences have dramatically altered our understanding of behavioral and emotional disorders during childhood. Though, ADHD is observed the commonest diagnosis among young children but the current scientific literatures recognize Emotional Disorders (ED) too as a common problem in young generation.

ADHD is a disorder of “inattention” and “poor inhibition” which encompass not just difficulties in listening to a speaker but also significant problems in a wide varieties of cognitive functions, including ability to activate and organize the work, ability to sustain attention, and ability to utilize memory function effectively.

The linkage of attention to memory has long been recognized and recent developments on this linkage mainly focus on its role in mental activities like working memory, verbal learning and memory
and visual learning and memory. Similarly, behavioral inhibition also plays an essential role in the proficient performance for different cognitive abilities. ADHD linked to behavioral disturbance and executive dysfunction have been found associated with impairments on memory tests. Children with ADHD may display deficits in their rehearsal strategies. Effects of rehearsal activity and level of word processing on learning disabled and normal readers’ free recall. Journal of General Psychology 108, pp. 61–72. View Record in Scopus | Cited By in Scopus (1) Swanson, 1983). Loge, Staton, and Beatty found that children with ADHD were impaired on the learning and delayed recall trials on an earlier research version of the CVLT-C. Other recent findings also suggest that impaired organization and regulatory processes are found associated with ADHD.

On the other hand, Emotional Disorders again confer an increased risk among children for interpersonal, psychosocial and cognitive deficits that persist long after the episode is resolved. “Emotionally handicapped” children are those, who exhibit (1) An inability to learn which cannot be explained by intellectual, sensory, or health factors (2) An inability to build or maintain satisfactory interpersonal relationship with peers and teachers (3) Inappropriate types of behavior or feelings under normal conditions (4) A general, pervasive mood of unhappiness or depression (5) A tendency to develop physical symptoms, pains, or fears associated with personal or school problems. The recent formulations of emotional disorders in childhood recognize that modulation of affect is often impaired as a result of emotional disturbances and that contribute cognitive deficits among children. But, the important aspects what remains to be clarified is the variety of mechanisms by which emotional influences (e.g., sadness, anxiety, terror, longing, affection, jealousy, rage etc.) both facilitate and impair the exercise of cognitive functions. Memory impairment has been found specifically associated with childhood depression. Some recent studies on adult patients show that depressive adults tend to have more problems with verbal learning and memory.

Similar kind of findings has been reported in children population also which show the relationship between anxiety disorders and verbal memory deficits as well as working memory. Since, several researchers have attempted to study the cognitive functions among children having childhood disorders with neurological basis and are known for associated cognitive deficits like impaired memory function, inattentiveness and impaired executive function but the area of emotional disorder among children always remained underemphasized despite the fact that clinicians frequently face complaints of poor academic performance, disturber peer group relationship and deteriorated cognitive abilities among these children. Therefore, the present study was designed to assess the nature of impairment in verbal learning and memory function among children with ADHD and ED and later on attempted to compare both the groups on different parameters of verbal learning and memory with each other as well as with normal control.

Methodology
Sample
Twenty ADHD children meeting the ICD-10 criteria for Hyperkinetic disorder/ADHD and twenty children having emotional disorders meeting the ICD-10 criteria under F-93 i.e. relating to anxiety and depression were included in the study. Both the clinical groups were compared with each others as well as with normal control group on the measure of verbal learning and memory. The following inclusion-exclusion criteria were applied to all the clinical subjects. Inclusion criteria: (1) the children aged between 8 to 12 years were included in the study, (2) the children meeting the criteria of ICD-10 for ADHD/Hyperkinetic disorder were included in the study, (3) the children with emotional disorder meeting the ICD-10 criteria of F-93 i.e. anxiety disorder and depression were included in the study, (4) the children having at least 6 months of illness duration were only included in the study. Exclusion criteria: (1) the children having delayed developmental milestones or subnormal intelligence were excluded from the study, (2) the children having any co morbidity with ADHD and emotional disorders were excluded from the study, (3) the children having history suggestive of any major medical illness and head injury were excluded from the study. Normal Controls: The samples for normal control group were selected
from general population independent of clinical group. The control group included those: (1) who were screened on the basis of Developmental Psychopathology Checklist for Children (DPCL) and rated to be normal, (2) the subjects, who were included in the study bearing no biological relation with any of those included in the clinical group, (3) the subjects having no history suggestive of any major medical, psychiatric or behavioral problems included in the study.

Variables and Measures

The present study utilized two classificatory variables i.e. the group of Emotional Disorder children and the group of ADHD children and one psychological variable i.e. Verbal Learning and Memory related to cognition. A brief description of these variables and their measures are given below. (1) ADHD and the Conners’ ADHD Rating Scale (CRS). This 10 items version, parents form scale was used to assess the degree and severity of inattentiveness, hyperactivity and impulsivity among selected samples. The items of the scale to be rated on four points rating scale, ranging from ‘not at all’ scored as 0 to ‘very much’ scored as 3. The total score on this scale could thus range from 0 to 30. With the method of scoring the cutoff point that gives optimum discrimination between clinically significant cases and normal children is 13. So the respondents with 12 or smaller scores are considered to be normal and those with scores of 13 or more are considered to be clinically significant. (2) Emotional Disorder and the Developmental Psychopathology Check List (DPCL). The DPCL is the check list has 124 items and six subsections. The subsections are (1) Developmental History (2) Developmental Problems (3) Psychopathology (4) Psychosocial Factors (5) Temperament and (6) Social Support and Assets. In the present study only third section i.e. Psychopathology which, consists of 50 items was used. Under this subsection the children are assessed for their externalizing problems of hyperactivity and conduct disorder, scholastic problems and internalizing problems like emotional disorder, neurotic illnesses and psychoses. The checklist is to be rated on two points rating scale ranging from ‘absence of particular symptoms’ scored as 0 to ‘presence of particular symptoms’ scored as 1. The high scores than cut off point on any dimension indicates the presence of that problem and vice-versa. (3) Verbal Learning and Memory and Rey Auditory Verbal Learning and Memory test (RAVLM): Verbal Learning is the means of acquisition of new verbal information about the environment and memory is the process of retaining it. The RAVLT was originally developed by Rey in 1965 and further adapted to suit conditions in India by Maj and his colleagues. It consists of words destination familiar objects like vehicles, tools, animals and body parts. There are two lists A and B with 15 different words in each list. Hindi adaptation of this test was used in the present study. Scoring: The total numbers of words correctly recalled over all the five trials forms the learning score. The number of words recalled correctly in the immediate recall trial, delayed recall trial and the recognition trial predict the memory score.

Procedure

The present study proceeded through the following steps. (1) Questionnaire Construction: Questionnaires were constructed consisting of three parts. The first part contained the informed consent form which was filled by legally acceptable representative of the patient, and personal data sheet to elicit demographic information regarding respondents’ age, gender, education, duration of illness etc. The second part included items from the Conners’ Rating Scale and Developmental Psychopathology Check List (DPCL) and the third part had assessment tools i.e. The Rey’s Auditory Verbal Learning and Memory Test (RAVLT), Hindi adaptation. The total assessment required approximately one and half hours to complete. (2) Data Collection: For collecting the data, the children with ADHD and ED meeting all the inclusion and none of the exclusion criteria were recruited from Psychiatry and clinical Psychology OPD units. The normal controls were taken from the school setting. Thus a total of 60 subjects, 20 in each group of ADHD, Emotional Disorder and Normal Control formed the sample and studied. (3) Statistical Analyses: The data were analyzed in two steps. (i) Means, SDs and ANOVAs were applied to study the impairment in Verbal Learning and Memory caused due to respondents’ nature of
illness, (ii) The t-test was done to see the effect of severity of illness within the experimental groups.

(4) Ethical Consideration: Informed consent was taken from all the participants as well as their key relatives included in the study. All the participants and their key relatives were ensured about the confidentiality of information. All the participants were allowed to have the free will or option of withdrawing their participation from the study at any point of time due to any personal or medical reason.

Results

A total 60 children, who met the inclusion criteria constituted the sample for the present study. The samples were divided into three groups, i.e. children with ADHD, children with Emotional Disorders (ED), and Normal Control group each consisting of 20 respondents.

Means, SDs and ANOVA

The result obtained from basic statistics and ANOVAs regarding the degree of psychopathology on the measures of ADHD, ED and Verbal Learning and Memory are presented in the Tables 1 and 2. Each of these tables has two parts A and B, containing Means, SDs summary ANOVAs and Bar Diagram description of the mean scores respectively.

Table 1: Mean Scores of degree of psychopathology of three Groups on DPCL and CRS.

B – Fig. 1: Bar Diagram description of degree of psychopathology on DPCL and CRS among the three groups.

Table 1 contains the results about psychopathology of inattentiveness, hyperactivity and emotional disturbances (anxiety and depression) among children with ADHD, ED and Normal Control. The table shows that children with ADHD showed higher degree of attention and hyperactivity than children with ED and normal control and the mean differences were found statistically significant (m=23.0, 3.65, and 1.65, F=153.41,
Similarly children with ED were found having higher degree of symptoms of anxiety and depression than children with ADHD and normal control and the mean differences were again noted statistically significant (m=12.60, 9.9, and 2.60, F=295.07, P=0.000). The result further indicates that children with ED showed higher degree symptoms of anxiety and depression however the children with ADHD were found having mainly symptoms of inattention and hyperactivity with mild level of emotional disturbances, which is quite obvious due to the nature of illness.

Table 2. Verbal Learning and Memory among children with ADHD, ED and normal control.

A – Means, SDs & ANOVA

<table>
<thead>
<tr>
<th>Variables</th>
<th>ADHD (n=20)</th>
<th>Emotional Disorder (n=20)</th>
<th>Normal Control (n=20)</th>
<th>F-Value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Total</td>
<td>Mean 42.55</td>
<td>Mean 52.95</td>
<td>Mean 63.95</td>
<td>246.86</td>
<td>.000**</td>
</tr>
<tr>
<td></td>
<td>SD 2.98</td>
<td>SD 3.97</td>
<td>SD 1.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recall after interference</td>
<td>Mean 7.60</td>
<td>Mean 10.95</td>
<td>Mean 13.90</td>
<td>149.93</td>
<td>.000**</td>
</tr>
<tr>
<td></td>
<td>SD 1.23</td>
<td>SD 1.15</td>
<td>SD 1.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delayed Recall</td>
<td>Mean 5.95</td>
<td>Mean 9.45</td>
<td>Mean 12.60</td>
<td>130.46</td>
<td>.000**</td>
</tr>
<tr>
<td></td>
<td>SD .998</td>
<td>SD .54</td>
<td>SD 1.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition</td>
<td>Mean 12.40</td>
<td>Mean 13.15</td>
<td>Mean 13.46</td>
<td>40.92</td>
<td>.000**</td>
</tr>
<tr>
<td></td>
<td>SD .994</td>
<td>SD 1.09</td>
<td>SD 1.35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** significant at .01 level

The table 2 shows the result regarding different parameters of verbal learning and memory. The table reflects that children with ADHD were found having poor verbal learning ability and their scores for learning total, recall after interference, delayed recall and recognition were found significantly lower than children with ED and Normal Controls. The mean differences for learning total suggests that ADHD children after the completion of trial could learn fewer words than children with ED and Normal Controls and children with ED performed better than ADHD but poorer than normal controls and the differences were noted to be statistically significant (m=42.55,52.95 and 63.95, F=246.86, P=0.000). Again the children with ADHD, could recall less words after interference than children with ED and normal control and the mean differences were observed statistically significant (m=7.60, 10.95 and 13.90, F=149.93, P=0.000). A similar pattern was noted for delayed recall also, suggesting that children with ADHD could recall less number of words after a delay of 20 minutes, than children with ED and Normal Control, and the
significant (m=12.40, 13.15 and 13.46, F=40.92, P=0.000), but the children with ED could recognize as much words as Normal Controls and were found comparable to them (m=13.15 and 13.46).

Test for Equality of Means
Further to see the effect of severity of illness on the measure of verbal learning and memory the test of equality of means was conducted on both the clinical groups. The children with ADHD were divided into two subgroups. The first ADHD group, who were found having score <22 on CRS consisted of 9 respondents, however the second group, who were found having score >22 on CRS consisted of a sample of 11 respondents. Similarly the children with Emotional Disorders (ED) were also divided into two subgroups. The first group, who were having score of <12 on DPCL and second that were found having score >12 on DPCL. Each subgroup of ED consisted of 10 respondents. The Tables 3 and 4 contains the results regarding verbal learning and memory corresponding to severity levels of children of ADHD and ED groups.

Table 3: Severity of illness and Verbal learning and Memory among ADHD Children.

<table>
<thead>
<tr>
<th>Variables</th>
<th>ADHD &lt; 22</th>
<th>ADHD &gt;22</th>
<th>t-value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=9)</td>
<td>(n=11)</td>
<td>df=18</td>
<td></td>
</tr>
<tr>
<td>Learning Total</td>
<td>Mean 42.333</td>
<td>42.727</td>
<td>-.287</td>
<td>.778</td>
</tr>
<tr>
<td></td>
<td>SD 2.12</td>
<td>3.635</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recall after interference</td>
<td>Mean 7.777</td>
<td>7.454</td>
<td>.574</td>
<td>.573</td>
</tr>
<tr>
<td></td>
<td>SD .803</td>
<td>1.507</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delayed Recall</td>
<td>Mean 6.111</td>
<td>5.818</td>
<td>.642</td>
<td>.529</td>
</tr>
<tr>
<td></td>
<td>SD .781</td>
<td>1.167</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition</td>
<td>Mean 12.333</td>
<td>12.454</td>
<td>-.264</td>
<td>.794</td>
</tr>
<tr>
<td></td>
<td>SD 1.000</td>
<td>1.035</td>
<td></td>
<td></td>
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</tbody>
</table>

Table 4: Severity of illness and Verbal learning and Memory among Children with Emotional Disorder.

<table>
<thead>
<tr>
<th>Variables</th>
<th>ADHD &lt; 22</th>
<th>ADHD &gt;22</th>
<th>t-value</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=9)</td>
<td>(n=11)</td>
<td>df=18</td>
<td></td>
</tr>
<tr>
<td>Learning Total</td>
<td>Mean 53.60</td>
<td>52.300</td>
<td>.721</td>
<td>.480</td>
</tr>
<tr>
<td></td>
<td>SD 4.551</td>
<td>3.434</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recall after interference</td>
<td>Mean 11.30</td>
<td>10.660</td>
<td>1.400</td>
<td>.179</td>
</tr>
<tr>
<td></td>
<td>SD .949</td>
<td>1.265</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delayed Recall</td>
<td>Mean 9.400</td>
<td>9.500</td>
<td>-.142</td>
<td>.889</td>
</tr>
<tr>
<td></td>
<td>SD 1.074</td>
<td>1.957</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognition</td>
<td>Mean 13.200</td>
<td>13.100</td>
<td>.200</td>
<td>.844</td>
</tr>
<tr>
<td></td>
<td>SD 1.032</td>
<td>1.197</td>
<td></td>
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</tr>
</tbody>
</table>
Thus severity of illness did not emerge as contributory factor for the degree of impairment in verbal learning and memory in the present study.

**Discussion**

The present study was designed with the aim to study the nature of impairment in verbal learning and memory among children with ADHD and Emotional Disorders (ED). The problems of learning and memory deficits during childhood can be studied dividing into two major classes: (1) the children with different types of disorders like ADHD, LD, etc. which have neurological basis, usually known for such types of deficits and (2) the children with emotional disorders who also show poor scholastic performance, poor decision making and poor learning and memory ability as well. A majority of studies have been undertaken with the aim to study the impairment in memory function among children with ADHD but the same among children with Emotional Disorders always has been underemphasized. Having these contexts in mind the present study was formulated in a way that a comparative study of degree of impairment in verbal learning and memory in both the groups could be done.

**Verbal Learning and Memory and ADHD**

Learning and Memory are the capacities by which a person experiences and retains the materials. Learning and memory are considered interdependent processes and the standardized measures which are used in the assessment of verbal learning and memory include list learning or paired-associate learning tasks such as those in the California Verbal Learning Test, Rey Auditory Verbal Learning and Memory Test etc. The present study used the RA VLM test to assess the verbal learning and memory function among the study subjects. The findings on this test revealed that children with ADHD have shown significant impairment in terms of verbal learning and memory. They have shown very poor performance on all the parameters such as learning total, recall after interference, delayed recall and the recognition of presented stimuli. This further suggests that children with ADHD have poor ability to learn the new verbal materials and also show difficulty in recalling and recognizing the exposed stimuli after a delay.

The earlier studies also favor the findings of the present study suggesting that ADHD children and adults have been found to be significantly impaired than normal controls on the measure of verbal learning and memory. Impairments in recall of short stories presented just once have been observed among children with ADHD. Mealer, Morgan and Luscomb found that ADHD children generally show poor short-term memory on the test of Wide Range Assessment of Memory and Learning. ADHD diagnosed children were reported significantly impaired on the measure of immediate story recall of the Children’s Memory Scale relative to their verbal IQ; the percentage of children showing significant discrepancy was much lower in normal controls in the standardization sample on this scale. Thus the earlier research findings support and validate the findings of the present study favoring the hypothesis that children with ADHD have impaired verbal learning and memory function.

**Verbal Learning and Memory and Emotional Disorders**

Jensen stated that under conditions of chronic stress or emotional disturbances both the short and long-term memory becomes inhibited. In the present study the children with ED were assessed on the test of verbal learning and memory. The mean scores on this test suggested that, the learning total, recall after interference and delayed recall of these children were found significantly poor but their ability to recognize the presented stimuli was found comparable to normal control. This further suggests that though the children with ED have poor ability to learn and recall the new verbal materials but when they are asked to recognize the stimuli presented in concrete manner, their performance are observed at par to normal control. The findings of present study are consistent with some recent findings of adult depressive patients showing that emotional disturbances contribute problems with verbal learning and memory.

Some other studies which have been conducted on children population have suggested that memory deficits are related to emotional disturbances like depression and anxiety. Verbal and visual memory deficits have also been shown in anxiety disorders like social phobia, PTSD, and panic disorder. A possible neurobiological explanation of the
specific memory impairment in children with emotional disorders might be as the deregulation in the hypothalamic pituitary adrenal axis associated with high cortisol levels has been linked to depressive disorders. Effects of cortisol hypersecretion on cognitive neuroendocrine functioning might explain memory dysfunctions in depressive children. Moreover, a continuous exposure of the brain to abnormal cortisol levels during development might contribute to the worsening of functioning in a greater range of cognitive domains. Thus, the findings support the hypothesis predicting that children with emotional disorder also have impairment in verbal learning and memory function.

Verbal Learning and Memory and children with ADHD and Emotional Disorders

The present study revealed the fact that both the groups of children with ADHD and emotional disorder have shown impairment in verbal learning and memory. But the children with ADHD have shown greater degree of impairment than children with Emotional Disorders on different parameters of verbal learning and memory functions. The mean values of learning total, recall after interference, delayed recall and recognition of words suggests greater degree of impairment among children with ADHD than children with emotional disorders. A different trend observed in the present study was, though the children with emotional disorders have shown impairment in terms of learning total, recall after interference and delayed recall than normal controls but when they were shown stimulus words to recognize, were found comparable to normal controls. Future researches are needed to substantiate and validate the findings of the present study.

Verbal Learning and Memory and Severity of Illness

In the present study the degree of severity of illness was assessed using CRS and DPCL. The children with ADHD were rated on Conners’ Rating Scale (CRS). However the children with Emotional Disorders were assessed using Developmental Psychopathology Checklist (DPCL) for their severity level. Higher the score showed greater the degree of severity and vice-versa. The findings of the present study revealed that both the groups of children with ADHD were found comparable to each other on different parameters of verbal learning and memory and severity of illness could not be observed contributory factor for the degree of impairment. A similar trend was observed between both the groups of children with emotional disorders also who were again found comparable to each other and overruled the impact of severity on the degree of impairment in verbal learning and memory.

An alternative explanation for the above findings can be as the sample size of the groups was small and severity wise also they were not significantly different to each other i.e. the comparison was made between moderate level and severe level of severity therefore the expected differences in level of impairment could not be observed. If the groups would have been classified in such a way that they are not closely associated with each other in terms of severity level then the bend would have been different on different parameters of verbal learning and memory.

Conclusion

While numbers of articles and books refer Attention Deficit and Hyperactive Disorder (ADHD) as a disorder of impaired cognitive function, the findings of present study and upcoming literature in the area of child mental health suggest that Emotional Disorders may also be associated with impairments in neurocognitive functioning such as short term memory, attentional ability and executive functions. The Emotional disorders in childhood have also begun to be recognized as a serious mental health problem and the problem of impaired memory functions are not confined to children with ADHD only but these are recognizable among children with other childhood disorders also. Thus the present study has attempted to make an important contribution to the existing literature of children with Emotional Disorder and ADHD by highlighting the status of learning and memory abilities and associated impairment in both the groups.

Limitations

In spite of several interesting findings the present study does have certain limitations. Some are highlighted as: (1) the locale of the present study, (2) the group of emotional disorders consisted of children with different types of anxiety disorders
and depressive disorders thus resulted in non-homogeneity within the group, (3) the sample in the present study was relatively small and accidental. A random as well as big sample size could have been more authentic and reliable and would have helped to its better generalizability.

References

Disord 2003; 82 : 2, 265 – 269.


