

SHORT-TERM MEMORY STATUS IN DEPRESSION PATIENTS OF NORTH KARNATAKA, INDIA

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ABSTRACT: OBJECTIVES: Cognitive deficit especially involving memory is associated with depression. The objectives of this study were to assess the short-term memory status in patients of depression and to compare the same with age and sex matched literate controls of north Karnataka (India). **METHODS:** 15 depressive patients were randomly selected with 37.7 ± 4.16 (Mean \pm SEM) and compared with age and sex matched normal literate controls individually for this study. Short-term memory status was assessed by using cognitive tasks, which included verbal tasks (non word repetition task, digit span test and word span test), and visual tasks (Benton visual retention test and object test). **RESULTS:** The depressive patients were found to be more affected in most of the verbal and visual task methods compared to normal controls.

CONCLUSION: Poor performance of verbal and visual memory tasks by the patients with depression might be at the level of attentional set shifting/working memory, processing speed and execution of task.

KEYWORDS: attention, cognitive task, depression, short-term memory.

INTRODUCTION: Short-term memory involves the maintenance of an active representation of information so that it is available for further processing. Memory tasks in which subjects retain the memory of a stimulus over a brief interval require both the perceptual encoding of the stimulus and subsequent maintenance of its representation after the stimulus is removed from the view. Such stimulus (for example verbal and nonverbal/pictures) will be processed to a deeper level and will be retained. Retention is a function of attention devoted to a stimulus, its compatibility with the analyzing structures, and the processing time available, will determine the depth to which it is processed, they are relatively slow and are subject to interference by other simultaneous controlled processes. At deeper levels the subject can make greater use of learned rules and knowledge, thus material can be more efficiently handled and more can be retained. The depressive syndrome is one of the oldest in psychiatry, having been clearly described by the physician of antiquity. ¹ Memory problems are common in depression like depressed people showed impairment in short-term verbal and nonverbal/visuospatial memory and long term memory and sentence-representation tasks. Hence, the person may have difficulties processing new and re-evaluating old information, which may lead to negative bias.

Depressed patients have also shown a greater tendency to perseverate and commit significantly more commission errors (intrusions, interference, addition of inappropriate material) on problem-solving tasks as compared to non depressed people. This may lead to the depressed person becoming stuck in a negative ruminative cycle.² Impaired cognitive function is considered to be a prime symptom of clinical depression.³ Neuropsychological studies have identified impaired short-term memory processing⁴ executive functioning⁵, deficit in sustained attention,⁶ impairment on tests of cognitive set shifting , spatial working memory, visual memory and psychomotor speed⁵, deficit in energy during both initial perceptual processing and organization and execution of psychomotor tasks in depression.⁷Therefore the aim of the study was to evaluate neuropsychological performance for short-term memory in patients with depression in comparison to their age, sex and education matched healthy individuals as control.

METHODS AND MATERIALS: SUBJECTS: Neuropsychiatric patients male or female (age: >18 years) with Mean age 37.7 ± 4.16 standard error of mean visiting the department of psychiatry of Al-Ameen Medical College Hospital Bijapur were volunteers for this study. 15 age and sex matched normal literate controls underwent screening to exclude any history of psychiatric illness, significant family history of mental illness or history of alcohol or other substance abuse. The neuropsychiatric patients were examined by a psychiatrist and the patients who met with the criteria of the diagnostic and statistical manual of mental disorders, fourth edition (DSM-IV)⁸ for one of the relevant diagnosis underwent screening for inclusion. Patients who presented with neurological disorders, head injury, a serious medical condition or a history of alcohol or other substance abuse were excluded. 15 depression patients were randomly selected and the presence of depression was assessed using Hamilton Depression Rating Scale (HAM-D).⁹ Patients and control provided written informed consent to participate in the study. Entire experimental protocol was approved by Institutional Ethical Committee (IEC) which follows Indian Council of Medical Research (ICMR) guidelines for Principles on Ethical Considerations Involving Human Participants.¹⁰

METHODS: Cognitive tasks were selected to assess short term memory by using

- (1) Verbal tasks, which include Nonword repetition task for motor fluency and coordination. Digit span test and Word span test from the Wechsler's memory scale revised (WMS-R) were used to assess attention /working memory and processing speed
- (2) Visual task methods which include Benton visual retention test and Object test to assess executive functions in visuospatial short-term memory.

PROCEDURE:

A) Verbal Tests:

(1) Nonword repetition task: Forty non words composed of 1, 2, 3 or 4 syllables were orally presented, subjects were asked to repeat each of them immediately, and results were expressed in percentage (%) depending on number of correct non word repetition.^{11, 12, 13}

(2) Digit span test: Six trials were given to both obsessive-compulsive disorder and depression patients and their respective age and sex matched controls. In each trial, sets of numbers from 1 number to 10 numbers (like 4, 35, 721 etc) were presented orally at the rate of one digit per second. Participants were asked to repeat the digits in same order as they have been presented and two attempts were allotted at each digit string length to each one of the participants. Test

would be discontinued when the participant failed two attempts at a given digit string length. Results were expressed in percentage (%) depending on the number of correct repetition of digits.^{14, 15}

(3) Word span test: The procedure is similar as digit span test except that the words were used instead of numbers.^{16, 17, 18}

B) VISUAL TESTS:

(4) Benton visual retention test: Ten trials were given, each trial had one card with three geometric figures which was shown for 10 seconds and the participant was asked to draw the figures in the same order immediately. Results were expressed in percentage (%) based on number of correctly drawn figures.^{19, 20, 21}

(5) Object test: 15 common objects were shown for 30 seconds. Participant was asked to write / tell verbally the name of the objects. Results were expressed in percentage (%).^{22, 23}

STATISTICAL ANALYSIS: Students unpaired “t” Test was used to compare the memory status of verbal short-term memory tests and visual short-term memory tests in patients of depression with control. The “p” value of <0.05 was considered as significant in all the tests.

RESULTS: For each trial, the groups mean performance and statistical comparison are summarized in Table 1. Analysis indicates that the patient groups differed based on the performance in verbal and visual tasks of short-term memory tests. The neuropsychological performances were observed on the following trials of verbal and visual short-term memory tests. The depressive patients showed a significant decrease in verbal short-term memory test in trial 4, 5 and 6 of digit span test and word span test ($p < 0.05$) where as the values of non word repetition task shows non significant ($p > 0.05$) values. The result also showed a significant decrease in visual short-term memory test in all the trials of Benton visual retention test ($p < 0.05$) except in trial 1, 2, 3 and 10 were noticed. Further a significant decrease in Object test ($p < 0.0003$) was noticed in depressive patients when compared with its controls.

DISCUSSION: In this study we have observed the neuropsychological performance for short-term memory using verbal and visual memory tasks in patients with depression compared to their respective controls. The results indicate that the depressive patients were more significantly affected in verbal and visual task methods in comparison to controls. The cognitive performance seems to differ depending upon the task analyzed is verbal or visual memory. The depressive patients were able to perform the initial trials of verbal and visual tasks but the later trials were difficult with respect to the increase in the number of verbal and visual stimulus which showed a significant decrease in the performance. The short-term memory is a limited capacity system that provides temporary access to a select set of representations in the service of current cognitive processes. It reflects focus of attention and awareness, the contents are updated effectively which is controlled by executive processes. The decreased performance in later trails is due to lack of attention/attentional set shifting, interference due to intrusion of irrelevant thoughts and easy distractibility due to depression which causes decreased processing capacity and execution of task. The processes that demand processing capacity are identified by the limits they place on simultaneous performance of other cognitive operations as compared to short-term memory tests of verbal and visual task methods. Severe and psychotic depression which grossly disables the patient socially could be expected to impair their cognitive-perceptual functioning significantly. Actual ability and performance during severe

depression is not consistent with the patient's unrealistically low image of himself. The patients experience of ego helplessness is more subjective than objective, more imaginary than real.²⁴ Subjects with depression were impaired in their ability to shift the focus of attention. They generally face difficulty to perform 'effortful' task as compared to 'automatic' task.^{25, 26} The depressive patients showed specific deficit in executive task ²⁷, characteristic of frontostriatal dysfunction and deficits in mnemonic tasks characteristic of temporal lobe dysfunction. This combination of a specific form of motivational deficit, resulting in oversensitivity to negative feedback, and superimposed specific neuropsychological deficits were correlated with severity of depression.²⁸ Mild depression is associated with a deficit in energy during both initial perceptual processing and organization and execution of psychomotor task.⁷ Depressive patients failed to use appropriate performance strategies spontaneously to the same extent as controls.¹⁷ Behavioral neuroscience results suggest that basal ganglia, which is involved in fronto-subcortical circuit, plays an important role in mediating learning in information-integration tasks.²⁹ The presence and maintenance of functional reciprocity between subgenual cingulate and right prefrontal cortex which shifts the mood in either direction suggests that these regional interactions are obligatory and probably mediate through the well-recognized relationships between mood and attention seen in both normal and pathological conditions.³⁰ Among the limitations of our study, we did not apply scales to assess the presence of anxiety and other subclinical symptoms in control group, although the presence of psychiatric illness was ruled out by the psychiatrist. During the study most of the patients were receiving psychopharmacological treatment and it might have an influence on their neuropsychological performance. However, previous studies have not found differences in cognitive performance between medicated and non medicated subjects.^{31, 32} We also like to point out regarding the non significant values of the non word repetition task indicating the motor fluency and coordination are unaffected in depression. On the basis of the above findings and taking in to account the limitation of our study we may conclude that patients with depression showed poor performance on verbal and visual memory tasks of short-term memory at the level of attentional set shifting/working memory, processing speed and execution of task as compared to their age and sex matched literate controls.

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Table 1. The 't' and 'p' value of unpaired 't' tests of Controls versus Depression patients.

Parameters	Controls (n=15) Mean% ±SD	Depression (n=15) Mean% ±SD	t-Value	p-Value
NonWord Repetition Task				
TR1	100±00	95.33±11.25	1.608	0.1191
TR2	100± 00	98.66±5.16	1.006	0.3232
TR3	100± 00	97.33±5.93	1.744	0.0922
TR4	100± 00	99.33±2.58	1.005	0.3235
DigitSpan Test (Forward)				
TR1	100±00	100±00	00	00
TR2	100± 00	100±00	00	00
TR3	100± 00	96.66±12.9	1.003	0.3246
TR4	81.11±28.08	51±38.08	2.464	0.0201*
TR5	52.2±12.72	12.5±23.62	5.731	0.0001*
TR6	22±14.24	2.66±10.32	4.259	0.0002*
WordSpan Test (Forward)				
TR1	100± 00	100±00	00	00
TR2	100±00	100±00	00	00
TR3	100± 00	98.33±6.45	1.003	0.3246
TR4	80 ±18.04	51.13±36.45	2.749	0.0103*
TR5	42.5±16.23	20.1±20.57	3.3110	0.0026*
TR6	22±9.411	7.33±15.79	3.0909	0.0045*
BentonVisual Retention Test				
TR1	100±00	93.4±13.66	1.871	0.0718
TR 2	98±8.61	84.4±30.52	1.6610	0.1079
TR3	86.67±27.6	59.9±42.22	2.0555	0.493
TR4	75.55±32.04	44.4±43.04	2.2484	0.0326*
TR5	80±27.6	40±40.29	3.1722	0.0037*
TR6	82.22±30.52	26.6±36.08	4.5584	0.0001*
TR7	58±42.66	26.6±31.4	2.2959	0.0294*
TR8	62.22±39.57	24.4±36.66	2.7154	0.0112*
TR9	64.44±34.43	24.4±38.81	2.9890	0.0058*
TR10	35.55±32.04	22.13±32.47	1.394	0.2642
Object Test	80.89±5.56	64.9±13.76	4.1729	0.0003*

Level of significance $p < 0.05$ *