

Comparison of Memory Deficits among Chronic Schizophrenics, Drug Addicts, and Normals

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Differences of memory deficits among chronic schizophrenics, drug addicts, and normals were investigated in the present study. Purposive sample ($N = 75$) of hospitalized patients, consisting of chronic schizophrenics ($n = 25$), drug addicts ($n = 25$), and normals ($n = 25$) was taken from Services Hospital, Mayo Hospital, Fountain House, and Mental Hospital, Lahore, Pakistan. No matching on gender and type of drug usage was carried out. Six different memory tests, verbal (story memory, words memory, non-sense syllables) and non-verbal (Visual Reproduction-sub test of Wechsler Memory Scale (Wechsler & Stone, 1948), Memory for Design test (Graham & Kendall, 1960), and Rey Complex Figure (Rey, 1941) were administered in the same order. Results supported the presence of memory deficits among chronic schizophrenics and drug addicts as compared to normal controls. Furthermore, chronic schizophrenics performed poorly on Words Memory test (meaningful) as compared to drug addicts.

Keywords: Memory deficits, neurological deficits, schizophrenia, drug addicts

Memory is central to all intellectual functions and to all that is characteristically human in a person's behaviour. It is highly sensitive to any physical illness or injury or brain damage. The present research was carried out to study whether memory is affected by chronic psychopathology and drug addiction. The present research is based on Landro, Orbeck, and Rund's (1993) study, who compared memory functioning among chronic and non-chronic schizophrenics, affectively disturbed patients, and normal controls. Keeping in view the serious

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physical and psychological complications of drug addiction and its impact on Pakistani society, the researchers intended to explore the affects of drug addiction on memory and utilized three groups (chronic schizophrenics, drug addicts, and normals) to compare memory deficits. It was expected that the patients with chronic psychopathology would exhibit memory deficits.

“Memory refers to the ability to revise past experience based on mental processes of learning or registration, retention, recall, or retrieval, and recognition; the total body of remembered experience” (Corsini, 1999, p. 581). According to Lahey (2007) it is a wonderful toolbar for human beings, which helps them to benefit from past experiences. Human memory has been considered a very important area for psychologists from the very beginning. Since Ebbinghaus who did extensive research on memory and constructed non-sense syllables and consonant-vowel-consonant trigrams to study retention and forgetting different paradigms, theories, and models have been presented to explain the core function of memory (as cited in Anderson, 2000). Information processing theories visualize memory as similar to computer processing based on operations such as input, storage, and retrieval (see, for example, Lahey, 2007). Atkinson and Shiffirin’s (1968) Storage and Transfer model explain three types of memory as sensory memory, short-term memory, and long-term memory.

Anderson’s Adaptive Control of Thought (ACT) Model (1983) distinguishes three types of memory structures; declarative, procedural, and working memory. It is a network model consisting of nodes which represent concepts. Links between the nodes represent relations between the concepts. These nodes and links when put together form propositions, the general thought that people experience. The model assumes that strength of links varies with the use and activation of concepts. Forgetting from long term memory occurs by both decay and interference decay. The model also explains the development of procedural memory which ultimately explains a wide variety of memory effects, higher order skills, and language learning. Baddeley’s (as cited in Anderson, 2000) theory of working memory explains two structures: articulatory loop (in which information is kept and can be rehearsed) and visuospatial sketchpad (a system to rehearse images) which helps to maintain information in working memory. According to Baddeley, these systems are controlled by a central executive, which also needs its own store of information to control these slave systems. These theories and relevant research have provided a consistent set of concepts about human memory which have played a very important role in stimulating further research. Moreover, technological advancement

in cognitive neuroscience has revealed extensive data which correlates memory with various brain areas (Gazzaniga, Ivry, & Mangun, 2002). Evidence suggests that different brain areas and chemical changes are involved in the storage and retrieval of memory. According to the concept of consolidation the chemical changes in the synapses which are the basis of memory remain fragile at first. They grow more permanent with time if nothing happens to disturb them (Dudai, 2004; Wixted, 2004).

Similarly different areas of frontal cortex play a vital role in maintaining information in working memory. Studies with patients of memory loss have revealed hippocampal formation as a critical area for the formation of permanent memories. Damage to hippocampal area also leads to severe amnesia in human beings (Anderson, 2000). In addition, it has also been shown that humans and monkeys with bilateral lesion of the hippocampus and surrounding cortex fail to show novelty preferences in the visual paired comparison task of recognition memory with very short delay. Adults with such lesions also perform poorly on deferred imitation task (Singh, 2005). Severely impaired memory isolates the patient from the meaningful contact with the world and deprives him of a sense of personal continuity, making him passive and helplessly dependent (Lezak, 1983).

Korsakoff's syndrome is one example of diseases leading to memory deficits. Neuroanatomical studies of patients reveal extensive peripheral nerve damage, lesion to the diencephalons (the thalamus and hypothalamus) and diffuse damage to other brain structures, most notably the neocortex and cerebellum (Gazzaniga, et al., 2002). Similarly retrograde and anterograde amnesia is characterized by lesions in lateral cortex of the interior temporal lobe and hippocampus respectively (Lahey, 2007).

Different psychological disorders may also lead to a variety of memory deficits. In anxiety people have difficulty in recalling persons, places and other stored information and have difficulty in locating objects. But amnesia experienced in psychosis, epilepsy, and head trauma is different from that experienced in anxiety (Reisberg, 1981).

Schizophrenia is a group of psychotic disorders having serious cognitive disturbances (Heinrichs, 2005). It is characterized by major disturbances thought, perception, emotions, and behavior. Disordered thinking in which ideas are not logically related, faulty perception and attention, bizarre disturbances in motor activity, flat or inappropriate affect, reduced enjoyment and interests (Davison & Neale, 1994;

Lahey, 2007). Different researches have been done to find out the causal factors of schizophrenia. Firstly, it was discovered that schizophrenia runs in families giving a genetic basis for the disorder. Environmental factors have also been discovered as a causal factor in schizophrenia (see, for example, Siever & Davis, as cited in Lahey, 2007). Other discoveries like CAT scan and postmortem neuroanatomical studies have revealed extensive brain damage in schizophrenics (James et al.; Hubl et al., as cited in Lahey, 2007). Different studies have revealed various cortical dysfunctions in different brain areas depending upon the subsyndrome of schizophrenia (Gelder, Lopez-Ibor Jr, & Andreason, 2000).

Intellectual impairment is another important feature of schizophrenia which has shown to be present in first episode untreated patients. It becomes worse in later years and reaches to dementia in severe and chronic cases (Goldberg, Hyde, Kleinman, & Weinberger as cited in Gelder, et al., 2000). In addition, the research has indicated the presence of greater deficits in semantic memory, executive functioning, and attentional domains (David & Cutting as cited in Gelder, et al., 2000). There is also an evidence of various cytoarchitectural alteration including abnormal neural organization in the entorhinal cortex, disarray of hippocampal neurons, an altered distribution of neurons in the subcortical white matter and decreased neural size (Harrison & Benes as cited in Gelder, et al., 2000). All these factors lead to a variety of symptoms and deficits in schizophrenia. Recent evidences support the presence of verbal and non-verbal memory dysfunction, poor recall, and cognitive impairments, which may be severe and similar in form as present in organic psychoses for example temporal disorientation (Barch, Csernansky, Conturo, & Snyder, 2002; Landro et al., 1993; Tracy et al., 2001).

Research has indicated significant verbal memory and learning impairment in first episode schizophrenic patients prior to any antipsychotic treatment (Hill, et al., 2004). Bruder, Wexler, Sage, Gil, and Gorman (2004) have also reported poor verbal memory among Dsz patients (schizophrenic patients screened for subtypes of schizophrenia) than NDsz (non-screened schizophrenic patients) and healthy controls. In addition, significant impairments have been found not only in schizophrenic patients on immediate and delayed recall of the logical memory, immediate recall of Visual Reproduction, and the Abstract Paired Associations test but also in their relatives as compared to controls (Toulopoulou, Rabe-Hesketh, King, Murray, & Morris, 2003).

Drug addiction is a common and serious problem of the present world. Drug is defined as "any substance, natural or artificial, other than food that by its chemical nature alters structure or function in the living organism" (Ray & Ksir, 2004, p.5). Drug use can take a form of deviant drug use, drug misuse, and drug abuse and is characterized by its frequency of intake usually daily use. Addicts often spend their time using the drugs, talking about the drugs, and obtaining the drugs. Pinel (1990) sees addicts as persons being trapped between drug taking, withdrawal symptoms, and further drug taking to combat the withdrawal symptoms. Drugs cause serious problems, and these effects are dependent on the amount and manner in which they are taken, individual's history, and his/her expectations (Ray & Ksir, 2004). Drug use leads to various problems including social, physical, legal, interpersonal, and psychological. Recent evidence has suggested that alcohol consumption is linked with high risk for violent crime, accidents at work, fatal and non-fatal driving accidents, drowning, burns, and suicide (Allan, Roberts, Allan, Pienaar, & Stein, 2001). Long term dangers include liver cirrhosis, hypertension, and Wernicke's encephalopathy characterized by memory deficits, ataxia, and confusion. If remain untreated leads to Korsakoff's syndrome which involves significant Retrograde and Anterograde amnesia.

Similarly, marijuana use leads to irreversible impairment of pulmonary functions. It also causes changes in heart and circulation. Another most important consistent effect is on short-term memory. Marijuana users have difficulty in learning and remembering new information. This memory dysfunction also affects their conversation (Ray & Ksir, 2004). In addition, researches by Berry, VanGorp, Herzberg, and Hinkin (1993) on neuropsychological deficits in abstinent cocaine abusers provide an evidence of memory impairment among addicts. They studied whether acute and short-term residual deficits in neuropsychological functioning were present in a sample of actually abstinent cocaine abusers. Their results suggested that recent cocaine use is associated with impairment in memory, visuospatial abilities, and concentration during the acute phase of withdrawal independent of withdrawal-related depression. Furthermore, many of these deficits appear to persist at least 12 weeks beyond cessation of cocaine use.

Keeping in view the possible presence of memory impairments in psychological disorders and drug addiction, the present research was designed to study and compare the memory deficits among chronic schizophrenics, drug addicts and normals. Following hypotheses were formulated:

1. Chronic schizophrenics will exhibit more memory deficits as compared to Normals.
2. Drug addicts will exhibit more memory deficits as compared to Normals.

Method

Sample

A purposive sample ($N = 75$) of hospitalized patients was taken from Government hospitals (Mayo Hospital, Mental Hospital and Services Hospital) and Fountain House (Rehabilitation Center) Lahore, Pakistan. They provide primary care along with hospitalization facility when needed. There were three groups, chronic schizophrenics ($n = 25$), drug addicts ($n = 25$), and hospitalized normals with other medical conditions ($n = 25$). No matching was done on gender men ($n = 41$), women ($n = 31$). Mean age of the participants was 34.23 years ($SD = 8.86$) and they had completed an average of 10.99 ($SD = 3.67$) years of education. Sample was provided by the concerned authorities according to the criteria given by the researcher:

- (1) The patient should be communicative enough to complete the tests.
- (2) The duration of illness for chronic schizophrenics should be from 5 to 15 years.
- (3) The duration of addiction for drug addicts should not exceed 5 years. No matching was done on type of drug usage.
- (4) Normal controls should be non addicts. They should be hospitalized with any other medical condition. The hospitalized patients were taken to control the effects of hospitalization as extraneous variable. Normal participants were taken as control group.

Instruments

Orientation of the subjects was assessed by 11 questions taken from Subtest of Wechsler Memory Scale (Wechsler & Stone, 1948). They were translated and adapted into Urdu according to the translation rules given by Brislin (1976). The total score ranged from

0-11. 11 were the maximum score showing good orientation and 0 was minimum score showing absence of orientation.

Assessment of Verbal Memory Deficits

The following tests were used to assess verbal memory deficits.

Test of Story Memory (Subtest of WMS-1948). Test of Story Memory was taken from the subtest of Wechsler Memory Scale (Wechsler & Stone, 1948). It was adapted and translated in Urdu by the authors as per rules (Brislin, 1976). It included two stories (two paragraphs) divided in units that provide a measure of the amount of information that is retained when more is presented than most people can remember on one hearing. This test characterizes free recall immediately after auditory presentation. The examiner reads two stories, stopping after each reading for the patient to give his/her immediate free recall. In the present research, two stories were administered. Story A consisted of 25 units, and story B consisted of 24 units. The total score was the mean of the units reproduced in both the stories that was 24.50. High mean values indicated good verbal memory where as low mean values indicated memory deficits.

Test of Words Memory (Kent & Rosanoff, 1901). Test of Words Memory consisted of 10 Urdu words. They were randomly selected from the list of Words Association Test (Kent & Rosanoff, 1901) and were translated into Urdu according to the rules given by Brislin (1976). The total score ranged from 0 to 10 according to the number of words recalled by the subjects.

Test of Non-Sense Syllables. Since Ebbinghaus, who did experimental studies on memory, non-sense syllables have been a popular medium for studying memory. They are used to study verbal functions while minimizing the confounding effects of meaning (Lezak, 1983). Test of non-sense syllables was consisted of 10 Urdu non-sense syllables (trigrams). It was developed by the authors for assessing memory deficits. The same scoring procedure was applied as for Word Association Test. The maximum score of the test was 10 and minimum score was 0, where high score indicated good verbal memory and vice versa.

Assessment of Non-Verbal Memory Deficits

To assess non verbal memory deficits the following tests were administered:

Visual Reproduction Test (Subtest of WMS- 1948). This is an immediate recall test. It consists of 3 cards with printed designs that are shown for 5 seconds. Following each exposure the subject drawn what he remembers of the design (Lezak, 1983). Maximum score for all the figures is 18. High score on test indicates good immediate recall ability.

Complex Figure Test (Rey, 1941). This test investigates both perceptual organization and visual memory in brain damaged subjects. The test material consists of Rey's Complex Figure on black typewriter size paper. Osterieth (as cited in Lezak, 1983) standardized Rey's procedure to measure immediate and delayed memory. The participants are asked first to copy the design and then to redraw after 5 minutes and then after 30 minutes. He obtained norms for comparing copy and recall trails. High score on each trial indicates good perceptual organization and visual memory. In the present research, three trails were given, including the time to copy the figures and recall after 5 minutes and then after 30 minutes.

Memory for Design Test (Graham & Kendall, 1960). This involves the presentation of simple geometric designs and the reproduction of these designs from immediate memory. The test material consists of 15, 5" cardboard squares, on which designs are printed. All of the designs are composed of straight lines to avoid scoring difficulties of curved reproductions. Each card is shown for 5 seconds and following each exposure, the participant draws the design. The total score on the test is the sum of the scores for each design that is determined by the number and kind of errors made. High score represents poor performance and vice versa. A score of 0 is given to satisfactory reproduction or to an omitted or incomplete reproduction. A score of 1 is given when more than two easily identifiable errors are made but the general configuration is retained. A score of 2 is given when the reproduction does not satisfy the above criteria and score 3 is given for the figures reversed or rotated.

Reliability

Pilot study was done to assess the authenticity and workability of instruments. Test-retest reliability of the six tests and Orientation test was calculated with 20 normal participants with one week interval. The reliability was found to be satisfactory: Orientation test (.51), Test of Story Memory (.70), Test of Words Memory (.67), Test of Non-Sense Syllables (.71), Visual reproduction Test (.68), Complex Figure Test-copy (.79), Complex Figure Test-IR (.77), Complex

Figure Test-delayed (.72) and Memory for Design Test (.79). After the successful completion of pilot study main study was conducted.

Procedure

After obtaining the written consent of the hospital authorities and of the respondents to participate, the participants were assessed on 6 different memory tests. Those who could not consent themselves, the permission were taken from their care takers and doctors. Firstly, the participant was seated comfortably and provided with a pencil and blank sheets of paper and then, was given instructions by the researcher. The questions for Orientation testing were asked e.g., what is your age? Where are you now? After completing the orientation test memory tests were administered separately one by one to each participant. Same procedure was repeated with each subject. As the procedure was time consuming, biscuits and candies were used as reinforcement for the participants. The whole procedure with each participant took 40-55 minutes.

Results

The present study was conducted to compare the memory deficits among chronic schizophrenics, drug addicts and normal controls. The first step of analysis was based on determining the correlations between scores of six tests (see Table 1). To find out the mean differences among three groups analysis of variance (one way ANOVA) was used (see Tables 2). After obtaining significant *F* ratio Post hoc test (Least significant difference) was applied on the three groups on the six memory tests.

Table1

Correlation Matrix among Three Groups on six memory tests (N = 75)

Tests	I	II	III	IV	V	VI	VII	VIII	IX
I. Orn.	-	.51**	-.40**	.59**	.40**	.40**	.34**	.18	.32**
II. V. Rep.	-	-	-.55**	.65**	.69**	.71**	.63**	.48**	.56**
III. M. Des.	-	-	-	-.69**	-.50**	-.50**	-.43**	-.15**	-.47**
IV Rey. C.F	-	-	-	-	.59**	.57**	.51**	.26*	.51**
V. Rey C.I	-	-	-	-	-	.97**	.58**	.36**	.61**

Continued...

Tests	I	II	III	IV	V	VI	VII	VIII	IX
VI. Rey. CD	-	-	-	-	-	-	.61**	.43**	.61**
VII. Story M	-	-	-	-	-	-	-	.35**	.62**
VIII. W. Mem	-	-	-	-	-	-	-	-	.29**
IX. Non-S. Syl	-	-	-	-	-	-	-	-	-

Note. Orn = Orientation; V.Rep. = Visual Reproduction; M. Des = Memory for Design; Rey. C. F Rey = Complex Figure (copy); Rey. CI = Rey Figure (immediate recall); Rey. CD = Rey Complex Figure (delayed recall); Story M = Story Memory; W. Mem. = Words Memory; Non-S.Syl = Non-sense Syllables; * $p \leq 0.05$. ** $p \leq 0.01$.

The results indicate significant correlations among all six verbal and non-verbal memory tests. The memory for Design test has significant negative correlation with other measures because of the difference in scoring procedure. In MFD the low scores exhibit good memory whereas in other tests high scores indicate good memory functioning.

Table 2

One Way ANOVA of Three Groups of six memory tests (N = 75)

Tests	Groups						<i>F</i>
	Schizophrenics		Drug addicts		Normals		
	<i>n</i> = 25		<i>n</i> = 25		<i>n</i> = 25		
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Orientation	7.96	1.88	8.24	1.83	9.32	1.49	4.24*
Visual Reproduction	7.20	3.64	7.44	3.51	11.68	2.59	14.74**
Memory for Design	11.64	8.74	11.28	7.39	1.92	2.02	16.94**
Rey Complex Figure (copy)	25.60	7.88	24.68	8.72	34.46	1.94	15.39**
Rey Complex Figure (immediate recall)	7.08	5.58	7.52	6.63	18.92	8.19	23.78**
Rey Complex Figure (delayed recall)	5.54	5.91	7.32	6.33	18.54	7.90	27.09**
Story Memory	5.98	3.22	6.10	2.74	10.88	4.86	14.11**
Words Memory	7.80	2.61	9.04	1.57	9.64	1.60	5.57**
Non-sense syllables	3.64	2.75	2.52	2.03	7.72	3.05	26.80**

df = 2, 72; * $p \leq 0.05$. ** $p \leq 0.01$.

Results of one way analysis of variance (Table 2) show significant differences between three groups on both verbal and non-verbal memory tests. It indicates that schizophrenics and drug addicts performed poorly on Orientation test $F = 4.24$ ($p < .018$), non-verbal memory tests (Visual Reproduction $F = 14.74$ ($p < .000$), Memory for Design $F = 16.94$ ($p < .000$), Rey Complex Figure (copy) $F = 15.39$ ($p < .000$), (immediate recall) $F = 23.78$ ($p < .000$), (delayed recall $F = 27.09$ ($p < .000$) and verbal memory tests i.e., Story Memory $F = 14.11$ ($p < .000$), Words Memory $F = 5.57$ ($p < .006$), Non-sense Syllables $F = 26.80$ ($p < .000$) as compare to normal controls. Furthermore, Post hoc (least significant difference) analysis was also performed using 0.05 level of significance for multiple comparisons. The mean score of schizophrenics on Words Memory Test (7.80) was significantly different from drug addicts (9.04) showing that chronic schizophrenics performed poorly on Word memory test (meaningful) as compared to drug addicts.

Discussion

The present study was carried out to compare the memory deficits among chronic schizophrenics, drug addicts and normals. Orientation test and six verbal and non-verbal memory tests were administered on the participants. It was hypothesized that schizophrenics and drug addicts will exhibit more memory deficits as compared to normals.

Results support the hypotheses and indicate the presence of more memory deficits among chronic schizophrenics and drug addicts as compared to normals.

On Orientation, story memory and Rey complex figure (copy) test [RCF] chronic schizophrenics and drug addicts differed significantly from normal controls indicating deficits in recalling present information, remote memory and immediate memory. Low scores on RCF (copy) indicated deficits in comprehending complex figure and motor functions. Further, the results revealed that on Visual reproduction test and Words memory test, chronic schizophrenics significantly performed more poorly from drug addicts and normals. These findings indicate a different pattern of memory functions in chronic schizophrenics. Results are consistent with previous researches (see, for example, Landro, et al., 1993; Sullivan, Shear, Zipursky, Sagar, & Pfefferbaum, 1994).

On tests of Words memory, Non-sense syllables, Visual Reproduction, Memory for Design, RCF (immediate recall), and RCF (delayed recall) the two groups including chronic schizophrenics and drug addicts differed significantly from normals suggesting more deficits in both verbal and non-verbal memory i.e., immediate recall; delayed recall. Results are consistent with Millsaps, Azrin, and Mittenberg's (1994) findings who examined the effects of chronic marijuana abuse on intelligence and memory in adolescents. The sample of 15 marijuana dependent abusers (mean age = 16.9) when tested on full Wechsler Memory Scale-Revised and the Wechsler Adult Intelligence Scale-Revised (WAIS-R) showed significantly reduced memory indices in relation to both intellectual function and attention ability. The presence of memory deficits among drug addicts may be attributed to the drug use itself. Because drug abuse can itself produce brain damage as chronic alcohol intake leads to Korsakoff's syndrome, characterized by variety of sensory and motor problems, extreme confusion, striking personality changes and a severe retrograde amnesia in addition to anterograde deficits. Postmortem neuroanatomical examination reveals extensive peripheral nerve damage, lesions to the diencephalons (the thalamus and hypothalamus) and diffuse damage to a variety of other brain structures including neocortex and cerebellum (Pinel, 1990).

Furthermore, the cognitive dysfunctions of drug addicts may have relations to family history as described by Rodriguez (1993), who studied cognitive functioning, family history of alcoholism and antisocial behavior in female poly drug abusers. Sample consisted of 42 Spanish female poly drug abusers whose main drug was heroin. Results revealed that family history of alcoholism and antisocial behavior had both independent and synergic negative relationship with abstract verbal reasoning. They observed that lower cognitive performance might reflect the family history of alcoholism or antisocial behavior rather than just drug abuse. Researches (e.g., Streissguth et al., 1994) have found out that drug abuse, specifically alcohol abuse during pregnancy can lead to memory deficits in children later on. Therefore, the causes for memory deficits among addicts can also be attributed to their mothers who may have history of drug abuse during pregnancy. Streissguth et al. (1994) studied adolescent attention/memory performance and its relationship with prenatal alcohol exposure in a longitudinal study with 462 adolescents aged 13.9–15.7 years, whose mothers had indicated their alcohol intake during pregnancy. Parental alcohol exposure was significantly related to attention/memory deficits in a dose dependent fashion. The

number of drinks/occasion was the strongest alcohol predictor. Fluctuating attention states, problems with response inhibition and spatial learning showed the strongest association with prenatal alcohol exposure.

During the research a difference of story reproduction on Story memory test was also observed between schizophrenics and drug addicts. Schizophrenics reproduced shorter stories whereas drug addicts gave long details including their own added sentences. Similarly, on design tests (Visual Reproduction, Memory for Design Test) schizophrenics showed signs of organicity as perseveration, rotation, tremors etc. as compared to drug addicts.

The results of the present study have supported the presence of memory deficits among chronic schizophrenics and drug addicts and suggest new directions for further research. There were certain limitations that are suggested to be addressed in future. The sample consisted of hospitalized patients and all of them were on medication. Therefore, memory dysfunction among chronic schizophrenics and drug addicts may also be attributed to their medicine intake. The reliability analysis was done on normal participants because of the unavailability of clinical population twice for retest. To overcome these limitations it is recommended to conduct intensive and extensive research with large samples to devise ways and means of efficacious treatment of the neuropsychological aspects of schizophrenia and drug addiction. Moreover, it is suggested to explore other factors (social, biological etc.) which may contribute to neurological deficits among schizophrenics and drug addicts. There is also a requirement to ask the authorities of the concerned hospital to provide facilities and environments conducive to research work for finding the best possible solutions.

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