

## Cognitive Deficits and Memory Disturbances in Patients with Chronic Post-Traumatic Stress Disorder

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Article information	Abstract
<p>Article history: Received: 11 July 2011 Accepted: 4 Aug 2011 Available online: 24 Oct 2012 ZJRMS 2012; 14(10): 73-78</p> <p>Keywords: Cognitive deficits Memory disturbance Post-traumatic stress disorder Veterans</p> <p>*Corresponding author at: Department of Psychiatry, Psychiatry and Behavioral Sciences Research Center, Mashhad University of Medical Sciences E-mail: talaeia@mums.ac.ir</p>	<p><b>Background:</b> Some studies have demonstrated high cognitive deficits in patients with post-traumatic stress disorder (PTSD). Considering the limited available information about this issue, we decided to assess the cognitive deficits and memory disturbances in these patients.</p> <p><b>Materials and Methods:</b> The present study is a case control research conducted on 50 patients with post-traumatic stress disorder who were admitted to Ibn-e-Sina psychiatric hospital in Mashhad, in north-eastern part of Iran in 2008. The control group included 50 people of first degree relatives of these patients who met the inclusion criteria of the study. Case and control groups were selected by simple sampling method; and for all of them, a questionnaire of demographic information, Wechsler memory scale, and mini mental status examination (MMSE) were completed. The gathered data were analyzed using SPSS 14th edition by chi square, <i>t</i>-test, and analyze of variance.</p> <p><b>Results:</b> The mean score of Wechsler memory scale in patients with PTSD (80.78±18.39) was significantly higher than control group (67.92±7.38) (<math>p=0.001</math>). The mean score of MMSE was significantly lower in patients with PTSD compared to control group (<math>p=0.001</math>). The determined disability level assessed by Iranian veterans' organization and also comorbidity of other psychiatric disorders with PTSD did not have a significant relationship with cognitive deficits, but the duration of PTSD and age of patients were significantly related to the level of cognitive deficits.</p> <p><b>Conclusion:</b> Cognitive deficits and memory disturbances are higher in patients with PTSD than general population.</p>

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### Introduction

Post traumatic stress disorder (PTSD) may be developed following being faced with serious stressful events and it has varying degrees of occurrence in many people. Patients re-experience a trauma in their dreams and also in their own daily thoughts (re-experience), they firmly tend to avoid everything which reminds them of the traumatic event (avoidance) and they feel numb in giving responses accompanied by a hyperarousal mood [1-3]. This disorder is a debilitating condition reducing patients' quality of life [4] and it is not only a mental impairment followed by experiencing a traumatic event, but it also brings about other challenges and disorders [5]. One of problems that have been recently considered is cognitive impairments and memory deficits. The existence of a possible relationship between memory impairments and PTSD has been discussed in different studies [6]. This disorder is often accompanied by deficits of the verbal memory which may affect therapeutic results and some case reports demonstrate that any treatment using memory and cognition improvement drugs lead to the significant recovery of the disease's symptoms, in particular, their hyperarousal state. Due to this very reason, cognitive and memory disorders are considered as one of foundations of this disorder's dysregulations which perhaps may result in

the occurrence of other symptoms in these patients [7]. A study conducted by Eren Kocak et al. showed that patients suffered by PTSD have a lower function than the control group in terms of the attention, the verbal memory, the verbal flow and the mental-movement speed [8].

In a study conducted by McNally, higher than average cognitive abilities are presented as a protective factor against PTSD and less than the average hippocampus' size is presented as a PTSD's predisposing factor in people who have experienced a trauma [9]. Using Wechsler's memory scale, Yehunda et al. also compared the memory function of individuals suffered by PTSD with individuals not suffered by PTSD and they showed that individuals suffered by PTSD have weaker memory functions than healthy ones [10]. In addition, in a study conducted by Bremner et al, evaluating the memory using Wechsler's memory scale, the patients suffered by PTSD achieved lower scores in comparison with healthy individuals. The result of this study was that short-term memories of patients suffered by PTSD may be impaired [11]. In other study conducted, the short-term memory disorder was reviewed in Vietnamese soldiers suffered by PTSD. The result of this study indicated that studying the immediate and delayed memory, people suffered by PTSD specifically achieved lower scores than the control

group. Also, Vietnamese soldiers suffered by PTSD had some disorders in areas of the short-term memory and the visual memory [12].

In a study conducted by Gil, the existence of cognitive problems in patients suffered by PTSD was discussed [13]. Studies performed on veterans participating in wars indicate that there is a relationship between the severity of stress caused by war and changes of the memory function [14-19]. The existence of cognitive disorders in patients suffered by PTSD was also presented in a study conducted by Demakis et al. [20]. Whereas the amount of studies conducted inside the country in this respect seemed to be limited, this study is conducted aiming at reviewing the incidence of cognitive impairments and memory in people suffered by post traumatic stress disorder compared to the group of non-suffered individuals.

## Materials and Methods

The present study is a cross-sectional case-control study conducted in Mashhad's Ibn-e-Sina psychiatric hospital which reviews the level of cognitive impairments and memory disorders of patients suffered by PTSD who were hospitalized in 2008 and compares them with a control group consisting of PTSD patients' first-degree relatives.

Since the beginning of the study, 50 patients suffered by PTSD who were admitted to Ibn-e-Sina psychiatric hospital and had the research design's entry eligibility criteria, entered into the study by the accessibility sampling method. PTSD in this group was diagnosed by a semi-structured interview based on DSM-IV and then it was approved by a psychiatrist and then, an informed consent form was filled out by all patients; the psychiatric disorders (primary psychosis or psychotic mood disorder) and any other serious clinical medical diseases were not observed based upon their medical histories and there was no trace of any mental retardation and all the subjects ranged in age from 18 to 65 years. Patients entering into research's design did not report taking any stimulant or opioid substances within the last month based on their clinical histories. Using the matching method, 50 persons having similar demographic attributes (age range, gender and socioeconomic status) who were satisfied with taking part in the study were selected. Wechsler's memory scale, MMSE (mini mental status examination) and a demographic inventory including gender, marital status and employment status, determined disability level (that is expressed in percentile), the level of education and the duration of illness were filled out by an expert psychologist for patients and the control group. All participants were assured that the research's results will be merely used for research purposes and inventories will contain no names so that those who were pleased with taking part in the study may feel free to fill them out. Using the SPSS-14 software and by means of descriptive statistical indices, results were studied. The comparison between different groups was also made using Chi-square, *t*-test and the analysis of variance.

**Wechsler's memory scale:** In this study, Wechsler's standardized test was used for measuring the amount of memory. This test has 7 subscales each of which determines the condition of separate parts of memory as well as determining the total score, i.e. the memory's general status. These 7 subscales include personal and general information, orientation, mental control, logical memory, letter-number sequencing, visual memory and associative learning. Studies performed in Iran indicate the good validity and reliability of this instrument [21-22].

**Mini-Mental State Examination Inventory:** MMSE is a brief 30-point application-clinical inventory used for the purpose of screening and it evaluates skills of orientation, registration of information, attention and calculation, recall and language [23]. This test is standardized in Iran and enjoys a satisfactory validity ( $\alpha=0.78$ ) and has 90% of the sensitivity and 84% of specificity at the cut-off point [24].

## Results

In this study, 50 patients suffered by the PTSD and 50 first-degree relatives of patients were studied by MMSE inventory and Wechsler's memory scale. A comparison of two groups' demographic information including job distribution, marital status and the level of education has been given in table 1. In addition, considering the distribution of the physical impairment percentage among patients, 80% of people had 5-25% of physical impairment percentage and 20% has 25-50% of the physical impairment percentage. In a performed study, 22% of patients had a history of at least one other psychiatric disorder while 78% of them were only suffered by post traumatic stress disorder.

The MMSE inventory's average score was 24.64 with the standard deviation of 2.58 in patients suffered by PTSD and it was 27.94 with the standard deviation of 1.43 in the control group and this difference was significant ( $p=0.0001$ ) using the *t*-test. Comparing the average score of Wechsler's memory scale in two groups, a significant statistical difference was observed using the *t*-test. In fact, the control group achieved a higher Wechsler's average score than patients. In addition, the control group obtained higher scores than the group of patient in most Wechsler's subscales except the mental control subscale and the personal and general information (Table 2).

As it is presented in table 3, a significant statistical difference ( $p=0.034$ ) was observed comparing the MMSE's average score between two groups of patients suffered by PTSD who were more and less than 45 years old using the *t*-test, as older patients achieved lower scores. However, comparing the average of Wechsler's memory scale subscales between two groups of patients who were more and less than 45 years old, a significant statistical difference ( $p=0.021$ ) was observed only in the subscale of personal and general information. In fact, less than 45 years old patients obtained higher score of the

personal and general information subscale than patients who were more than 45 years old.

No significant statistical difference was observed ( $p=0.851$ ) comparing the MMSE's average score between two groups of patients having determined disability level of more than 25% and less than 25% using the *t*-test. However, comparing the average score of subscales of logical memory ( $p=0.014$ ), letter-number sequencing ( $p=0.019$ ) and associative learning ( $p=0.016$ ) between two groups of patients having the physical impairment percentage of more than 25% and less than 25%, a significant statistical difference was observed using the *t*-test, as the average of scores of logical memory, letter-number sequencing and associative learning subscales was higher in the group of patients having more than 25% of determined disability level. In order to study the role of the duration of PTSD affection in cognitive impairments, a comparison was made between patients suffered by PTSD for more than 15 years and patients whose histories showed less than 15 years of being suffered which indicated a statistically significant difference in MMSE's score between these two groups. The results of this comparison are given in table 3.

In addition, a significant statistical difference was observed ( $p=0.046$ ) comparing the average score of Wechsler's memory subscale of orientation in patients with an illness's history for a duration of less and more than 15 years using the *t*-test, as the score of this subscale was higher in the group having a history of less than 15 years. Using the *t*-test, no significant statistical difference was observed comparing the average total Wechsler's memory scale and subscales score in patients having less or more than 15 years of illness history. As it has been given in table 3, no statistically significant difference ( $p=0.511$ ) was observed comparing the average score of MMSE between patients with or without any other psychiatric history using the *t*-test.

No statistically significant difference ( $p=0.754$ ) was observed comparing Wechsler's total and subscales scores between patients with and without other psychiatric disorders using the *t*-test

**Table 1.** Comparing frequency of demographic variables in patients suffered by PTSD and the control group

Variable		Case	Control
		N (%)	N (%)
Job distribution	Retired	5 (10)	12 (24)
	Employee	10 (20)	32 (64)
	Unemployed	35 (70)	6 (12)
Marital status	Single	1 (2)	2 (4)
	Married	49 (98)	48 (96)
	Illiterate	5 (10)	2 (4)
Level of education	Elementary	28 (56)	16 (32)
	Diploma	12 (24)	21 (42)
	Above Diploma	5 (10)	11 (22)

**Table 2.** Comparing of the test's score and Wechsler subscales in the group of patients suffered by PTSD and control group

Variable	Group	Mean	SD	df	<i>p</i> -Value
General information	Control	5.42	0.731	98	0.255
	Case	5.26	0.664		
Orientation	Control	5.00	0.000	98	0.0001
	Case	4.56	0.760		
Mental control	Control	3.86	2.010	98	0.184
	Case	3.42	1.162		
Logical Memory	Control	4.87	3.430	98	0.0001
	Case	2.64	1.588		
Letter-Number Sequencing	Control	6.72	1.896	98	0.008
	Case	5.88	1.043		
Visual memory	Control	8.18	2.738	98	0.0001
	Case	5.66	2.172		
Associative learning	Control	9.76	4.322	98	0.0001
	Case	6.80	2.213		
Total score	Control	80.78	18.390	98	0.0001
	Case	67.92	7.381		

**Table 3.** Comparing MMSE's score in patients suffered by PTSD considering age, duration of the disease and comorbidity variables

Variable		MMSE		df	<i>p</i> -Value
		Mean	SD		
Comorbidity	Exist	24.18	3.341	48	0.511
	Not Exist	24.77	2.367		
Duration of disorder	≤15 year	25.42	1.724	48	0.029
	>15 year	23.79	3.092		
Age	≤45 year	25.14	2.451	48	0.034
	>45 year	23.47	2.588		

## Discussion

In this study, the average score of MMSE and total Wechsler's memory scale and Wechsler's subscales with the exception of subscales of mental control and the personal and general information was higher in the control group compared to patients' group.

These findings were similar to the study conducted by Bremner et al., as while evaluating Wechsler's memory scale, patients suffered by PTSD achieved a lower score compared to healthy individuals in both studies [11]. In a study conducted by Yehuda et al., individuals suffered by PTSD demonstrated weaker memory functions than healthy ones and our study also arrived at a similar result [10]. The results of the present study was similar to studies of Sodic et al., Sutherland et al. and McNally et al. since there was an association between memory's disorders and the incidence of PTSD [12, 25-26].

The results of our research was similar to the study conducted by Gil et al., as there was an association between cognitive impairments and the incidence of PTSD [13]. In the study of Demakis et al., the existence of cognitive impairments in PTSD patients was also approved similar to our own study [20].

In a review conducted by Sally et al, patients suffered by PTSD compared to non-suffered individuals had a reduced function in scales of verbal memory and also the visual memory [27].

To verify this finding, Johnsen et al. found that veterans suffered by PTSD have a lower verbal memory [28]. Burriss et al. also reviewed veterans suffered by PTSD in terms of memory disorder in their own study. In this research, veterans suffered by PTSD achieved lower scores in Wechsler's subscale including learning associations than veterans not suffered by PTSD [29]. Also, in our research, the score of this subscale was significantly lower in individuals suffered by PTSD than non-suffered ones.

In Bremner's study, similar to our own study, a great difference is reported in terms of logical memory's subscale between the group of patients suffered by PTSD and the control group [30]. On the other hand, the study of Elsesser failed to find the verbal memory's impairments in patients suffered by PTSD compared to the control group. However, this lack of difference can be due to the sample's limited number and other limitations of the methodology used for this study [31]. In their study, Neylan et al. also achieved results against our study. Tomas et al. found that educated men suffered by PTSD, who are not suffered by a simultaneous depression or are not suffering from alcohol and drug abuse, do not have any difference with healthy individuals concerning attention and learning tests and Wechsler's memory subscales [32]. However, in our study, the group suffered by PTSD obtained significantly lower scores in most of Wechsler's subscales except subscales of the mental control and the general and personal information than the control group. The reason behind the discrepancy of results of this study with our research may arise from differences of samples.

In the study of Bremer et al., some educated individuals whose academic years' average was 15.1 years were chosen; however, in our study, the majority of patients suffered by PTSD were only able to read and write. Also, outpatients suffered by PTSD who had good function were reviewed in Bremner's study; while, in our study, patients were hospitalised. Thus, it is possible that neuropsychological tests applied for Bremner's study are not enough for PTSD suffered outpatients who have good functions and are educated and the study might be unable to diagnose memory's minor impairments in these individuals. Different entry criteria of the study conducted by Thomas including nonexistence of any major depression episode during last 3 months and also any alcohol and drug abuse during recent 5 years was among other reasons of the inconsistency of our study's results with that of Bremner et al. Such entry criteria help to the formation of a bias in the sampling, so that individuals enter into the study that has milder post trauma stress disorders. The average age was also higher in Bremner's study than other studies that approve memory and cognitive disorders in people suffered by PTSD [11]. However,

this matter cannot justify negative results of this study. Since the age has some impacts on the memory and the biological response to stress, age-related changes can directly affect the incidence of PTSD symptoms and memory-related complaints [32].

The present study showed that the age in the patients affected MMSE's average score and the subscale of personal and general information. In fact, less than 45 years old patients obtained higher MMSE's score and general and personal information subscale's score than more than 45 years old people. According to this research, patients having less than 15 years history of illness obtained higher MMSE's and the orientation subscale's average scores than patients who have more than 15 years of illness duration. However, the illness history did not affect the average total score of the Wechsler and its subscales.

Sutker et al. found that veterans with an average age of 56 years had more complaints related to the reduced concentration and the reduced immediate and delayed memory [33]. Eitinger also reported a more evident reduction in memory in older individuals [34]. This question still remains regarding the nature and the severity of a cognitive impairment in older veterans and also the fact that in addition to harmful effects of age, how much the stress or PTSD contribute to the memory disorder of older people suffered by PTSD [35].

In addition, determined disability level plays an important role in older people's memory disorder. As an example, malnutrition and reduction in weight are accompanied by the weaker functions in memory measurements [36]. This research showed that the determined disability level affected the score of some of Wechsler's scale subscales including the logical memory, the letter-number sequencing and associative learning. In this study, patients with more than 25% of the determined disability level achieved a higher average score of logical memory, letter-number sequencing and associative learning subscales in comparison with patients with less than 25% of the determined disability level. This finding is not expected in our own study and it is also mentioned in other studies that comorbidity of psychiatric disorders associated with physical injuries (that in some way may include a higher determined disability level) cause more impairments in memories of individuals suffered by PTSD; however, a significant reduction in the function of memory in case of non-existence of these symptoms is also reported [35].

In our research, as well as post traumatic stress disorder, the history of other psychiatric impairment did not affect MMSE's score and Wechsler's total and subscales scores. Three studies had findings which contradicted our own study [37-39] and the study conducted by Barrett is considerable. Barrett's study showed that evaluating the cognitive function, 236

veterans suffered by PTSD in comparison with 1836 persons in the control group did not achieve lower scores; while, 128 veterans, who had a comorbidity disorders such as depression disorders, anxiety disorders or substance abuse beside PTSD, had a specifically lower performance [37].

The existence of a major depressive disorder comorbidity with PTSD is considered as a problem in most PTSD-related studies and some studies suggest that the depression is bilaterally and inevitably associated with PTSD [40] and the diagnosis of PTSD cannot solely have a strong association with cognitive impairments; thus, the existence of the major depressive disorder must be carefully considered as a probability [31].

Another point to consider is that are cognitive impairments the underlying cause of the post trauma stress disorder or are they its complication? In a research performed by Parslow and Jorm, it was observed that individuals showing PTSD symptoms had a lower cognitive function before the trauma [41]. This point has not been reviewed in our study; however, reviewing the existence of memory disorders and cognition prior to PTSD's incidence is suggested for subsequent studies. The study of other cognitive functions including the evaluation of concentration and active memory, story recall test, planning and organized skills that have higher level of sensitivity during the evaluation of neuro-cognitive function is also suggested. In general, this performed study consistent with some other studies deals with cognitive and memory impairments in patients suffered by PTSD. It is highly important in terms of both the evaluation and

treatment of patients, as while evaluating the severity of illness if there is a cognitive impairment, there will be a great possibility of a bias and an unreal record of symptoms' severity which may turn into a problem while choosing an appropriate therapy. It may also be one of reasons behind the recurrence of PTSD. On the other hand, ignoring cognitive problems and their role in how the patient can cope with his/her disorder and also the patient's relationship, even the patient's job performance may worsen the prognosis of the disorder.

The present article had also some limitations including the low size of the sample. In addition, some confounding factors like medication and severity of the illness were not omitted in this study. In addition, all patients are suffered by an acute and war type PTSD which makes it difficult to generalize results to other disorder.

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### Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

### Conflict of Interest

The authors declare no conflict of interest.

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