




Comparison of the Neurological and Neuropsychological Functions Within Depressed Patients with and Without Suicidal Thoughts

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Abstract

Objectives: This study was designed and conducted to compare the neurological and neuropsychological functions of depressed patients with and without suicidal thoughts.

Methods: This research is a case-comparative study. A group of depressed patients visited NAJA Imam Sajjad Hospital between early August and late October 2016. According to the Morgan table, 66 individuals (33 with suicidal thoughts and 33 without) were selected for comparison with controlled variables in this examination. The Beck Depression Inventory (BDI), Neurological Evaluation Scale, and Wechsler Memory Scale (for neuropsychological function) were administered to all the participants. Data were analyzed using one-way analysis of variance (ANOVA), Scheffe follow-up test, and SPSS version 22 software.

Results: The findings indicated that the group of depressed patients with suicidal thoughts showed poorer scores in neurological functions compared to the control group ($P = 0.01$). Furthermore, the control group scored higher than the depressed group with suicidal thoughts on the Wechsler Memory Scale ($P = 0.05$).

Conclusions: The results suggest that depressed patients with suicidal thoughts exhibit worse performance in both neurological and neuropsychological functions compared to the non-suicidal group.

Keywords: Suicide Thoughts, Depression, Neurologic Function, Neuropsychological

1. Background

Depression is associated with impairments in brain function (1). Numerous researchers, neuroscientists, and neuropsychologists have focused on studying the relationship between normal brain functions, brain dysfunctions, and behavior. In line with this growing field, recent studies highlight the importance of neuroanatomy and neurofunction-encompassing both neurology and neuropsychology in examining psychological phenomena (2-5). Particularly in the context of mood disorders and depression, the role of neurological factors is increasingly recognized (1-3, 6, 7). The hippocampus, a crucial brain region involved in learning and memory, plays a pivotal role in significant cognitive and executive functions, notably in both short-term and long-term memory retention (8-10). It is particularly engaged in tasks (11) requiring delayed

recall, and damage to it is linked to increased problems with declarative memory (12). Magnetic resonance imaging (MRI) studies have revealed that individuals with severe depression often have a reduced hippocampal volume (13-15). Other critical areas implicated in the physiological impact of depressive disorders include the basal ganglia, which are essential for learning, declarative memory, and short-term memory retention (16-18). The thalamus is another brain region identified as being involved in depression through brain imaging studies (19, 20). Research using MRI to measure volume (21) and studies on post-mortem brains (22) have found that the thalamic volume in depressed individuals, compared to a healthy control group, is reduced. Furthermore, patients with thalamic lesions are more prone to experiencing memory function issues, including difficulties in encoding and recall (23).

These studies highlight the connection between neurological and neuropsychological impairments and depression. As noted, many of these impairments are associated with deficits in cognitive executive functions, including learning and memory. The findings from most studies in this area suggest that depressed patients experience more memory problems than the general population (3, 24, 25). Indeed, some research indicates that these issues are more pronounced in depressed patients with suicidal thoughts (7, 26, 27).

Depression is characterized by reduced pleasure, feelings of guilt, thoughts of death, and suicide (26). Neuropsychological dysfunction in the realm of depression, particularly regarding executive thinking functions, plays a significant role as a risk factor for suicide (7). Neurochemical research reveals a relative overlap between individuals prone to violence and impulsivity and those who commit suicide, including a low level of Serotonin (5-HT) and its primary metabolite, 5-hydroxyindoleacetic acid (5-HIAA), in the brain anatomy of individuals who have committed suicide (7). Various studies on the cognitive functions of suicidal individuals have been conducted. Using standard neuropsychological tools, it has been found that suicidal individuals, compared to those with chronic pain and the general population, exhibit reduced fluency (verbal and non-verbal) and reasoning (7). However, other studies have not found such neuropsychological differences (28). It has been observed that poorer decision-making, as another cognitive function, is evident in suicidal patients compared to the general population, with a negative correlation between the inclination for suicide and decision-making ability (12).

The information presented above demonstrates the presence of structural and biochemical brain damage and dysfunction in depressed and suicidal individuals. Moreover, it has been established that these damages and dysfunctions are related to cognitive functions, including memory.

2. Objectives

Despite the diversity of findings across different studies, the current research aimed to address this variability and shed further light on the subject. It seeks to pose its central question: Is there a difference in neurological and neuropsychological functions

between depressed patients with or without suicidal thoughts?

3. Methods

This study is a causal-comparative research. The study population consisted of all male patients of the psychiatry department at Imam Sajjad Hospital, aged 18-55, who were literate in reading and writing. The total number of participants was 80, who were admitted from early August to late October 2016. Utilizing the voluntary sampling method and Morgan's table, 66 individuals (33 depressed and 33 depressed with suicidal thoughts) were selected as the sample and compared with 33 individuals without depression or suicidal thoughts. The sample members were also matched for demographic characteristics, including age, gender, economic status, and intelligence. All participants completed the Beck Depression Inventory (BDI) for a more accurate diagnosis of depression, the Beck Automatic Thoughts Questionnaire for identifying depression with suicidal thoughts, the Neurological Evaluation Scale (NES), and the Wechsler Memory Scale to assess neurological and neuropsychological attributes. Raven's Progressive Matrices were used to ensure the subjects were comparable in terms of intelligence.

3.1. Beck Depression Inventory Questionnaire (Revised Version BDI-II)

This tool is a 21-item self-report questionnaire designed to assess symptoms of depression (29). The questionnaire has been translated into Persian, and both the original and the Persian versions have high validity and reliability (30).

3.2. Beck Scale for Suicidal Ideation Questionnaire

The Beck Scale for Suicidal Ideation Questionnaire (BSSI) was utilized to measure suicidal thoughts. This questionnaire consists of 19 items with three options each, designed to express, measure, and evaluate attitudes and plans for attempting suicide. It assesses factors such as the desire for death, active/inactive suicide tendencies, the duration and frequency of suicidal thoughts, self-control, deterrent factors, and readiness for suicide. The questionnaire includes five screening items; if these are positively identified by the individual, they continue answering; otherwise, it is not

required. The score range is from 0 to 38. The questionnaire is highly reliable; for example, Beck reported a reliability coefficient and inter-rater reliability of 0.89 and 0.83, respectively (31). In Iran, this instrument has been standardized, with one study reporting an internal consistency coefficient of 0.95 and its concurrent validity at 0.76 (32).

3.3. Neurological Evaluation Scale

Developed by Buchanan and Heinrichs in 1989, this 26-item scale evaluates three functional domains: Sensory integration, motor coordination, and complex motor sequences (33). It also includes assessments for short-term memory, symptoms of frontal release, and abnormalities in eye movement. Both the total score and the scores for each of the four subscales are used to evaluate the intensity of neurological disorders. The interclass correlation coefficient for subscale scores and the total score for motor coordination is 0.63, and 0.99 for sensory integration. Completing this scale takes approximately 45 minutes. Items are presented in a fixed order and are rated on a scale from 0 to 2, except for the sucking and snout reflexes, which are scored as 0 or 2. Scores for all three domains and other items are calculated. In this study, only the total score of the scale was utilized.

3.4. Wechsler Memory Scale

This scale serves as an objective tool for evaluating memory and is utilized for the clinical assessment of fundamental memory aspects in adolescents and adults. It functions as a screening and diagnostic tool in neurological examinations (13). The test comprises various sections, including awareness of daily and personal matters, orientation to time and place, mental control, logical memory, memory span, visual reproduction, and learning associations (13).

4. Results

Table 1 shows the baseline demographic information (age, gender, education, economic status, and intelligence) for the studied groups. These variables were measured and assessed through additional questions added by the researcher at the beginning of the study questionnaires. An evaluation of this data indicated that the three studied groups are

homogeneous with respect to these characteristics, showing no significant differences.

Table 1. Demographic Information of the Groups ^a

Variables	Group			P-Value
	Depressed with Suicide Thoughts	Depressed Without Suicide Thoughts	Normal	
Age	26 ± 1.32	25 ± 0.91	24.5 ± 2.1	0.33
Economic condition	2.01 ± 1.38	3.09 ± 1.45	1.48 ± 1.14	0.15
Intelligence	109 ± 2.17	107 ± 3.22	109 ± 1.16	0.28

^a Values are expressed as mean ± standard deviation.

Table 2 displays descriptive statistical metrics (mean, standard deviation, maximum, and minimum) for all variables across the three groups.

Table 2. Descriptive Variables in Comparing Groups

Variables and Groups	Values ^a	Max	Min
Neurologic Evaluating Scale			
Depressed with suicidal thoughts	1.88 ± 1.18	5	0
Depressed without suicidal thoughts	1.25 ± 0.54	4	0
Normal	0 ± 0	0	0
Wechsler Memory Scale			
Depressed with suicidal thoughts	93.57 ± 14.92	114	66
Depressed without suicidal thoughts	99.81 ± 14.31	126	70
Normal	11.96 ± 3.30	114	61

^a Values are expressed as mean ± standard deviation.

To compare the neurological and neuropsychological aspects of depressed patients with and without suicidal thoughts and a control group, one-way analysis of variance (ANOVA) and Scheffe follow-up test were employed to pinpoint the exact differences among the studied groups. Table 3 presents a comparison of all variables across the three groups. In determining the significant differences between multiple means, the one-way ANOVA, along with post hoc tests, compares estimates of variance both between and within each of the sample groups. The purpose of ANOVA is to ascertain whether the variances observed between the samples are attributable to random error (sampling errors) or to systematic effects that cause scores in one group to diverge from those in another. ANOVA assumes a normal distribution of data and homogeneity of variance, meaning the variances among the groups should be

approximately equal and that the observations are independent. These assumptions were taken into account in this study.

Table 3 indicates that there is a significant difference in neurological functions across the three groups ($P = 0.01$), as well as in the Wechsler Memory Scale ($P = 0.05$). To identify where the differences precisely lie among the study groups, the Scheffe Follow-Up Test was applied, with results detailed in Table 4.

Table 3. One-Way Analysis of Variance Results for Comparing Executive Functions in Groups

Change Sources	Sum of Squares	df	MS	F	P-Value	η^2
Neurologic functions (NES)	23.09	2.96	11.95	7.33	0.001	0.69
Wechsler memory	1334.38	2.96	667.19	3.54	0.033	0.32

Table 4. Scheffe Follow-Up Test for Checking Differences in Aspects of Wechsler and Neurologic Functions in Groups, Respectively

Samples 1 and 2 ^a	Average Difference	Standard Error	P-Value
Depressed with suicidal thoughts			
Depressed without suicidal thoughts	6.24	3.37	0.187
Normal	-2.48	3.37	0.763
Depressed without suicidal thoughts			
Depressed with suicidal thoughts	-6.24	3.37	0.187
Normal	-8.72	3.37	0.040
Normal			
Depressed without suicidal thoughts	8.72	3.37	0.040
Depressed with suicidal thoughts	2.48	3.37	0.763
Depressed without suicidal thoughts			
Depressed with suicidal thoughts	-0.63	0.30	0.125
Normal	0.54	0.30	0.216
Depressed with suicidal thoughts			
Depressed without suicidal thoughts	0.63	0.30	0.125
Normal	1.18	0.30	0.001
Normal			
Depressed with suicidal thoughts	-1.18	0.30	0.001
Depressed without suicidal thoughts	-0.54	0.30	0.216

^a It means two depressed groups with and without suicidal thoughts, which can be written as groups instead of samples 1 and 2.

Table 4 presents the Scheffe follow-up test results for the Wechsler Memory Scale and neurological functions.

The findings in Table 4 reveal that the control group scored significantly higher than the depressed patients with suicidal thoughts on the Wechsler Memory Scale, pertaining to neuropsychological assessments, with this difference being significant at the 0.05 level. Additionally, the results showed that the depressed group with suicidal thoughts scored higher in neurological functions compared to the control group, with a significance level of 0.01.

5. Discussion

The current study was conducted at NAJA Imam Sajjad Hospital to compare the neuropsychological functions and neurological features of individuals with and without suicidal thoughts within a standard group. The results indicated that the control group scored significantly higher on the Wechsler Memory Scale, a neuropsychological assessment used in this study, compared to depressed individuals with suicidal thoughts, with this difference being significant at the 0.05 level. Numerous studies in this field have shown that depressed patients experience more memory problems and issues than the general population (3, 24, 26, 33). Indeed, some research highlights that these problems are more pronounced in patients harboring suicidal thoughts. Studies by Keilp et al. revealed that individuals who had attempted suicide exhibited more impairments in attention and memory than those who had not attempted suicide and the control group (26). Buchanan and Heinrichs found that depressed individuals performed worse in attention, memory, executive functions, and decision-making (33). The findings of Keilp et al. indicated that the neuropsychology of individuals who attempt suicide is more adversely affected, with some results pointing to impairments in executive functions, including cognitive abilities, attention, and memory (7).

The examination of memory issues in depressed patients has a long history. Several key points can be mentioned to explain these findings. Firstly, depressed patients with suicidal thoughts experience more severe and indeed different memory problems, which could be a contributing factor to suicidal ideation. Secondly, the results of this study (showing no difference in memory problems between patients without suicidal thoughts and the general population) lead to an important conclusion: Depressed patients only exhibit more significant memory issues than the control group if

they have a history of suicide attempts or suicidal thoughts. This aligns with the conclusions of Keilp et al., Malloy-Diniz et al., and Buchanan and Heinrichs. However, the question of how suicidal thoughts contribute to more significant memory issues in depressed individuals with such thoughts, compared to those without, remains a subject for future research (7, 27, 33). Neurological functions and soft neurological signs are indicators that cannot be linked to a specific part of the brain and are likely signs of a widespread and decentralized brain disorder (30). Scoring higher on these assessments, including the NES used in this study, indicates poorer neurological conditions in the examined group. The findings of this study, showing diminished function in depressed individuals compared to the control group, largely coincide with other research in this area.

Lewis et al. suggest in their study that neurological factors, along with the damage they entail, may contribute to suicidal attempts and ideation. This review highlights neurological disorders and damage that can amplify suicidal thoughts and attempts (34). Coughlin and Sher demonstrated a direct link between suicidal thoughts and behaviors, concluding that these are associated with the neurological aspects of certain conditions (35). Encounters with existing neurological conditions and patient features might lead individuals to view suicide as the only viable solution to insurmountable life challenges. A key takeaway from this study is that the presence of neurological symptoms, due to their profound impact on patients' lives, necessitates a resolution to end this diminished quality of life and the emergence of suicidal thoughts, with suicide potentially being seen as such a resolution. This explanation gains weight when considering that depressed patients without neurological symptoms exhibit suicidal thoughts and, consequently, less inclination toward suicide. Therefore, what distinguishes two groups of depressed individuals from one another, or the inferred cause, is the presence of suicidal thoughts.

5.1. Conclusions

We deduce that neurological and neuropsychological factors differ in patients with and without suicidal thoughts. This differentiation necessitates distinct approaches in the treatment and management of these

patients, which therapists and mental health professionals should take into account.

Footnotes

Authors' Contribution: All parts of the article are written by the responsible author.

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Data Availability: The datasets generated or analyzed during the current study are available at the request of the corresponding author.

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