

Diagnosis of brain dysfunction using Benton visual retention test in Iran

Zahra Tajali¹, Changiz Rahimi^{2*}, NorolahMohamadi², Hosseinali Khalili³

¹ MA. in Clinical Psychology, Shiraz University, Department of Clinical Psychology, Shiraz, Iran, ² Ph D. in Clinical Psychology, Professor, Shiraz University, Department of Clinical Psychology, Shiraz, Iran, ³ MD. Associate Professor of Neurosurgery, Trauma Research Center, Shahid Rajaei (Emtiaz) Trauma Hospital, Department of Neurosurgery, Shiraz University of Medical Sciences, Shiraz, Iran.

Correspondence: Changiz Rahimi, Professor, Dept. of Clinical Psychology, Faculty of Education and Psychology, University of Shiraz, Shiraz, Iran, Email: crahomi2016@hotmail.com.

ABSTRACT

Introduction: Neuropsychological tests have an important role in diagnosis of brain lesions. Purpose of this study was to determine differential diagnosis of patients with brain damage and normal subjects using Benton Visual Retention test in Iranian population. **Methods:** The research population included patients with brain trauma of Shahid Rajaei Hospital and patients with cerebral vascular accident of Namazi Hospital in Shiraz, Iran. 12 patients were selected by purposive sampling method and compared with 12 normal subjects. The Benton Visual Retention test was used for this comparison. **Findings:** Analysis of data using independent t-test indicated a significant difference between patients with brain trauma and cerebral vascular accident, and normal subjects. It means that patients with brain trauma and cerebral vascular accident had weaker performance in this test in order to visual perception than normal subjects. The results indicated the weakness of the majority of patients with brain damage and cerebral vascular accident in visual memory compared to normal subjects. **Discussion:** The results showed that the Benton Visual Retention test can differentiate between brain damage patients and normal subjects in Iranian population.

Keywords: Benton visual retention test, Brain damage, Neuropsychological tests.

Introduction

Neuropsychological tests are a group of psychological tests which have been remarkably advanced in recent years. These tests allocate to the study of brain and behavior. They are based on this principle that brain damage is along with some changes in cognition and behavior. There are several changes in different types of cognitive functions depending on type, severity and location of the brain lesion [1].

Different methods such as, neurologic examination, electroencephalography, brain CT-scan, positron emission tomography (PET), measurement of local brain blood flow and etc., have been used by specialists for studying the relationship between brain, cognition and behavior. Neuropsychological

assessment is another method for studying brain function which is rooted in clinical psychology, and the same cognitive abilities evaluated in neurologic examination are studied in a more precise, comprehensive and objective manner [2]. The most common usage of this method is determining and assessing cognitive and behavioral changes caused by brain damage [3] and that is why neuropsychological tests can help clinical psychologists, psychiatrists and neurologists in responding clinical situations such as early diagnosis of brain damage, determining weaknesses and strengths of patients with cognitive impairments, assessing therapeutic and rehabilitation programs, determining patients care, prognosis of disease and so on [4].

With all precision of diagnostic tools in brain damage, structural changes are specified mostly and it is not clear that these changes have behavioral importance. Also, these methods of diagnostic neural impairment do not consider communication between hemispheres and neural network connection which is responsible for disseminating information across the brain, and when we are talking about the relationship between brain and behavior we mean the relationship between behavior and brain functional mechanisms which is mediator of these behaviors. Even when location and extent of brain lesion is specified in tomography, the tomography cannot identify the nature of

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remaining behavioral force and defect along with it, so neuropsychological assessment is required.

It has been known for decades that despite the overall similarity of spatial patterns of brain functions, these patterns vary among individuals. Neural tomography of three patients with the same frontal lobe lesions shows different psychological results^[5]. Furthermore, psychological assessments can prove inconsistency of mental abilities with findings of anatomic, so neuropsychological techniques are required as necessary part of diagnostic tools for brain dysfunctions^[1]. Neuropsychological assessment is a method for testing brain by product of behavior, but it covers more states of the mind^[1]. Available surveys show that various tests are used in neuropsychological domain. Generally, these studies indicate that tests such as Luria-Nebraska test, Wisconsin Card Sorting test, and the Rey Osterrieth Complex test are mostly used in this domain^[6].

History of neuropsychological assessment, as a very specific domain dates, back to 1950s and to the works of Halstead, Reitan and Goldstein in the United States, Rey in France and Luria in the Former Soviet Union. Alexander Luria and Andrea Rey did not emphasize much on close observation of individuals in tests, but they paid more attention to their operation on the acquired scores. Their works were based on a qualitative approach. Instead of preparing and arranging quantitative-based tests, Luria developed a set of methods which might be useful in expressing the appropriate and required behaviors of patients. From the beginning, two distinct strategies were introduced in this domain. One of these strategies was based on extensive and comprehensive tests previewed by Halstead and Reitan, and another approach was more inflexible and qualitative strategy which was introduced by Rey, Goldstein and Luria^[7].

The Benton Visual Retention Test (BVRT) was invented by Benton, and then revised by Syvan. This test was applied for assessing child and adults' spatial-visual perception, spatial-visual memory, and visual-motor abilities. The BVRT is a graphic test which its primary goal is analysis of individuals' cognitive situation, it is also used in screening individuals in order to diagnosis of brain damages, but its clinical functions are far beyond that^[8].

Despite the important role of visual-spatial memory in specifying brain damages caused by trauma and cerebral vascular accident, few studies have reported about the impacts of different factors on visual-spatial working memory of brain damaged patients. Therefore, most studies focused on identifying the nature and impacts of physical and cognitive consequences of brain damages caused by trauma and cerebral vascular accident. Nevertheless, the study about working memory failure in brain damaged patients caused by trauma and cerebral vascular accident is at its early stages and is looking for more growth and development. In this study, visual-spatial working memory of brain damaged patients caused by trauma and cerebral vascular accident were examined by the BVRT. Purpose of this study was differential diagnosis of brain damaged patients and normal subjects using the Benton Visual Retention Test in Iranian population.

Methods

The method of this study was casual-comparative. Statistical population of the study included patients with brain damage of Shahid Rajaei Hospital and patients with cerebral vascular accident of Namazi Hospital in Shiraz. The sample consisted of 12 brain damaged and cerebral vascular accident patients with an average age of 34/58 years. The patients were chosen by purposive sampling method and normal subjects were chosen by purposive sampling method among staff of the hospitals. Inclusion criteria for this study were age range from 15 to 55 years, literacy at reading and writing level, no visual impairment, no sensory-motor impairment in hands, desire to participate in the research, no mental illness background and admission at psychiatric hospitals. Normal subjects were chosen from staff of Shahid Rajaei and Namazi Hospitals who were matched for their age and education with patients. The Benton Visual Retention test was implemented on both groups.

Measures

The Benton Visual Retention test (BVRT): BVRT is a clinical and research instrument designing for assessing visual perception, visual memory, and somatic vision abilities. There are three parallel forms (C, D and E) in this test and each form has ten cards, and each card contains one or more geometric shapes. The needed time for administration of each form is 5 minutes and there are 4 different methods to examine perception and memory. Scoring methods for this test include counting the number of correct reconstructions and counting the number of errors. Special types of numbers of errors are classified into six groups: omission, transformation, perseveration, rotation, mistake placement, and false scale which were included 64 special errors at all. Test reliability which was obtained by calculation of correlation among peer forms is between 80 to 90%^[9]. Procedure D of the Benton test was administered in this study for assessing visual memory. It is said to the subject that a card is shown to him/her which contains one or more shapes and he/she must show the card for 10 seconds, then the card is put aside and after 15 seconds he/she must draw what he/she has seen. Despite other administration methods, white sheet and pencil is not given to the subject at first. Instead, immediately after 15 seconds a single sheet of paper in 10 to 15, a pencil and eraser is given to the subject. Erase and correction are allowed. After he/she finishes his/her drawing, he/she gives back it and the pencil. Each card is displayed without any explanation, except in the case of submitting a third plan (the first design consists of two main shapes and a small lateral shape) examiner must say to subject that "Do not forget draw everything you see". If subject forgets to draw the lateral form in reconstruction of his/her reproduction of design 3, examiner should repeat those statements before displaying design 4. No immediate admiration is expressed, but if subject asks about his/her performance, he/she can be reassured. Sometimes, subject tries to speak with examiner during those 15 seconds. In such situation, examiner should encourage the subject to focus more on design and memorize it. Some subjects try to memorize

designs by drawing them by their fingers. This is free, unless no visible signs are made by fingers ^[10].

Procedure

All patients were tested individually in hospitals. A written commitment was made by the participants in relation to their voluntarily participation in the test. The participants were allowed to leave the test whenever they wanted. Finally, results of the test were scored by experienced clinical psychologist.

Statistical Method

The gathered data were analyzed using descriptive statistical methods and independent t-test.

Findings

The results of this study showed a significant difference between visual memories of brain damaged patients and normal subjects in the BVRT. Table 1 and diagram 1 show mean scores of two groups of patients and normal subjects.

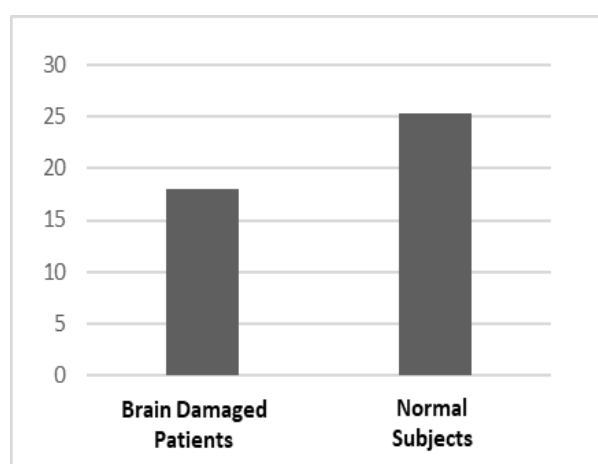


Diagram 1: Mean and standard deviation of the Benton Visual Retention test scores in brain damaged patients and normal subjects

Table 1: Comparison between scores of brain damaged patients and normal subjects in the Benton Visual Retention test

Leven Test	Groups	M± SD	N	Min	Max
F=2.6 p=0.11	Brain Damaged	18.0±5.90	12	6	27
	Normal Subjects	25.41±3.20	12	22	29
Independent t-test			t= 3.87	P< 0.001	

As it is shown in table1, there is a significant difference between mean scores of correct reconstructions of brain damaged patients and normal subjects in the BVRT and brain damaged patients' mean scores of correct reconstructions are less than those of normal subjects. Obtained mean scores in visual memory scale show that brain damaged patients remember fewer designs than normal subjects. Independent t-test had been used for checking the meaningfulness of this difference which the null hypothesis is rejected and the research hypothesis is confirmed. It means than there is a significant difference

between visual memory of brain damaged patients and normal subjects in the BVRT, and visual memory of brain damaged patients' performance is significantly weaker than normal subjects.

Discussion and Conclusion

Findings of this study showed that brain damaged patients' performance in the BVRT is significantly weaker than normal subjects' performance. It means that brain damaged patients' performance in terms of visual memory were weaker than normal subjects in the BVRT. The results of this study generally coincide with other studies in this field. Studies of Shafiei et al (2016) were done with the purpose of examining the visual-spatial memory of patients with mild brain damages using the BVRT ^[11]. Findings of this study showed that there was a significant difference between normal subjects' performance and traumatic brain patients in implementing procedure A and procedure D. In general, these findings showed the more successful performance of normal subjects in this test. A research was conducted by Creasy et al (2016) with the purpose of examining the BVRT patients with Alzheimer type of dementia. The findings showed that patients with Alzheimer had worse performance than other groups such as caregivers, spouses and relatives. Taylor (1979) with the purpose of studying brain damaged patients' performance with Andrea Rey's test realized that patients with right hemisphere lesions had problems in copying designs and even a bigger problem in remembering. Ariza et al (2006) studied the kind of lesions in sample of subjects with severe and moderate brain damages which were related to specific patterns of memory impairment ^[12]. By using the Rey Osterrieth Complex test, they concluded that temporal lobe damage in brain damaged patients had specific relationship to memory impairment.

According to the results of this study, the Benton Visual Retention test can be used as an acceptable assessment tool for diagnosis of visual memory disorder. This research has some limitations. One of the major limitations and weaknesses of this study is its small sample size and use of patients with mild brain damages without considering patients with moderate and severe brain damages. Despite the limitations of this study, the present findings offer new evidence of psychometric properties in assessing visual memory of brain damaged patients. Considering that the sampling method of this study is purposive, so generalization on these results should be done with caution.

This research has some suggestions including, studying and comparing tests in patients with brain tumor, in order to study the performance of patients with brain tumor in these tests; studying and comparing tests in patients with brain lesions in each lobe; studying the performance of accidental patients with moderate and severe brain damage; researching on larger samples; researching with sex differentiation of patients and comparing both genders performance. At the end, it can be concluded that brain trauma and cerebral vascular accident, despite its mildness, can have a significant impact on visual – spatial memory impairment of patients.

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