



Pathology of Visual Memory in Patients with Epilepsy

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Quantitative Study

Abstract

Background: Epileptic seizures have destructive effects on the brain, because they intervene in healthy and normal brain processes, and create interference at different stages of memory and cause malfunction in its performance and function, especially in the early years of life. The purpose of this study was to investigate memory as one of the important areas of cognition in patients with epilepsy.

Methods: In this causal-comparative study, the subjects consisted of 52 children of 8 to 14 years of age with epilepsy. Among them, 15, 16, and 15 patients had parietal lobe epilepsy, temporal lobe epilepsy, and frontal lobe epilepsy, respectively. The participants were selected among the patients referring to the clinic of a neurologist. Rey-Osterrieth complex figure (ROCF) test was used to assess visual memory.

Results: The visual memory scores in the epilepsy group were lower than the healthy group and the difference between the two groups was significant ($t = 33.76$, $df = 103$, $P < 0.001$). No significant difference was obtained between the three epilepsy groups in terms of visual memory scores ($f = 1.6$, $df = 2$, $P < 0.212$). In the present research, no significant difference was observed in visual memory between the three epilepsy groups.

Conclusion: It can be concluded that patients with epilepsy have impaired visual memory.

Keywords: Epilepsy, Visual memory, Rey–Osterrieth complex figure test

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Introduction

Epilepsy is a complex organic process that occurs in the brain; it is a comprehensive and progressive symptom of neural damage. In this state, the firing of neurons in certain areas of the brain is excessive, unpredictable, and disorderly. Extensive researches in the field of brain function disorder have shown that, in addition to the physical effects of

convulsion, and its psychological, social, and economic effects, the main complaint of these patients is cognitive damage particularly to memory (Cornaggia, Beghi, Provenzi, & Beghi, 2006). Therefore, epilepsy and cognition have a complex and reciprocal relationship and the pathology is largely a result of psycho-pathology of epilepsy. There are many difficulties to studying memory in patients with epilepsy. The most important difficulty is to control the factors that are effective in the cognitive process of these patients; these factors include age at onset of

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epilepsy, convulsion, convulsion intensity, type of epilepsy, and consumable drugs (Desai, 2008). In the present research, visual memory and the effects of the two factors of type of epilepsy and age at its onset on the amount of cognitive vulnerability were investigated in these patients.

Visual memory is a system that encodes the stream of stimuli, retains the codes related to previous stimuli, compares the codes for two stimuli, and operates based on the result of the comparison. Neuropsychologists believe that by providing images for patients with epilepsy and refreshing their memory through those images, they can embark on the analysis of differences in the damaged area of the brain. The results of these researches have shown the differences in the cognitive problems of children with different types of epilepsy. In a comparison of the tasks related to attention and memory between three groups of patients with frontal lobe epilepsy, temporal lobe epilepsy, and absence epilepsy, and the control group, the three groups of patients received scores lower than the control group (Hernandez et al., 2003). Among the patient groups, children with frontal lobe epilepsy earned lower scores than the other two groups, and children with temporal lobe epilepsy, compared to patients with absence epilepsy, obtained lower scores (Hernandez et al., 2003). In another research on visual memory, children with frontal lobe epilepsy, in comparison with children with temporal lobe epilepsy, obtained lower scores (Petty, Gross, Brewer, & Davis, 2008). In terms of cognition, patients with frontal lobe epilepsy have shown more vulnerability than patients with temporal lobe epilepsy (Helmstaedter, 2002).

Epileptic seizures have destructive effects on the brain, because they intervene in healthy and normal brain processes, and create interference at different stages of memory and cause malfunction in its performance and function, especially in the early years of life. The importance of early years of life in the development of mental

processes has caused researchers to consider the age of onset of epilepsy as an important factor in the intensity and vulnerability of memory in patients with epilepsy. Moreover, it seems that patients with lower age of onset of seizures show more cognitive deficits in neurological tests (Pavone et al., 2001).

Memory, among the mental forces, is more delicate and more fragile and the importance of understanding the impact of memory defect in everyday activities on individuals' quality of life (QOL) has been clearly determined in researches. Furthermore, epilepsy is a multifaceted disorder that has an unspecified, complex, and sensitive border between neurology and psychology. With the consideration of these facts and that memory defect can cause essential psychological symptoms, such as depression, anxiety, and psychosis, we can comprehend the importance of investigating memory in patients with epilepsy and move in this direction.

Methods

A) Participants and research design: In this causal-comparative study, the subjects consisted of 52 children of 8 to 14 years of age with epilepsy. Among them, 15, 16, and 15 patients, respectively, had parietal lobe epilepsy, temporal lobe epilepsy, and frontal lobe epilepsy. The participants were selected from among patients referring to the clinic of a neurologist. The study inclusion criteria included diagnosis of epilepsy based on the results of electroencephalogram (EEG), lack of psychiatric disorders including learning disorders and attention deficit hyperactivity disorder (ADHD), and attendance of ordinary schools. The control group consisted of 52 individuals (28 girls and 24 boys); after randomly selecting areas and schools in Tehran, sampling was continued until reaching the desired number of subjects (equivalent to the patient group). The inclusion criterion of the control group was lack of epilepsy and other psychiatric disorders based on clinical interview. This group was matched with the patients group

in terms of gender, age, socio-economic class, and educational level of parents.

B) Tests: One of the most famous tests on perceptual and visual memory is the Rey-Osterrieth complex figure (ROCF) test that was proposed for the first time in 1942 by Rey and was investigated by Osterrieth (Figure 1). The ROCF test entails the copying and recreation of a cumulative figure from memory. This test consists of two cards (A and B); in this research, card A was used. Card A consists of 18 cognitive parts and is executed in two stages (copying and reminding). The results of factor analysis indicate that this test covers 5 sets of psychoneurological functioning; memory of the visual-spatial reminder, memory of visual-spatial recognition, response orientation, processing speed, and the ability of visual-spatial structuration. In addition, this test can distinguish patients with brain damage and mental disorders from healthy individuals. Each copy is scored for the accurate reproduction and placement of 18 specific design elements. The validity of this test was reported as 77% in the copy stage, 51% in the representation stage, and 62% in the narrative stage (Yar Ahmadian, 2007).

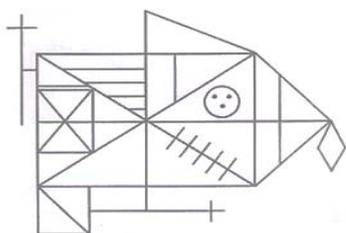


Figure 1. Recreation of a cumulative figure

C) Stages of experiment performance:

The shape of card A of the ROCF test does not have a specific meaning and its graphical realization is also simple. The complexity of the shape structure is in the analyzing and organizing of cognitive activity required for drawing it. The test is performed individually and in two stages. In the first stage, the card is placed on an appropriate side in front of the participant and he/she is asked to draw it on a white paper without

lines. This stage shows the participant's perceptual and organizing activity. In the second stage, the card is removed, and after 3 minutes has elapsed, the participant is asked to accurately draw the mnemonic of the previously observed image from memory. The scores resulting from the second stage represent the amount of visual memory of the participants. There is no time limit in these stages.

Results

Based on the results of the ROCF test, the visual memory scores in the epilepsy group (18.55 ± 4.35) were higher than the healthy group (11.22 ± 6.56) and this difference between the two groups was significant ($t = 33.76$, $df = 103$, $P < 0.001$).

In patients with epilepsy, the average and standard deviation of age of onset of epilepsy was 8.27 ± 2.971 . A significant correlation was observed between age of onset of epilepsy and visual memory scores; visual memory score was lower in patients with lower age of onset of epilepsy than patients with higher age of onset of epilepsy ($r = 0.75$, $P < 0.01$).

The results of the ROCF test in patients with epilepsy in the 3 groups of parietal (16.64 ± 6.07), frontal (20.30 ± 6.19), and temporal (6.80 ± 19.43) epilepsy did not show any significant difference between the visual memory scores in the 3 epilepsy groups ($f = 1.6$, $df = 2$, $P < 0.212$).

Discussion

The main objective of this study was to investigate visual memory as one of the important cognitive fields in patients with epilepsy. The results showed that visual memory in patients with epilepsy was weaker than healthy individuals; these results correspond with the findings of previous researches (Frank, & Landeira-Fernandez, 2008; Cornaggia et al., 2006). Due to the importance of memory as a cognitive ability and the high probability of its vulnerability in brain damage and various clinical conditions, it has become an

important field of investigation for neuropsychologists. The confirmation of this hypothesis can approve the efficiency of the ROCF test in the diagnosis of brain damages and their distinction from healthy individuals. Researchers suggest that cognitive defect is influenced by different factors, of which in this research the effect of age of onset of epilepsy and kind of epilepsy were investigated. Luria (1969) has gone beyond the traditional neuropsychological model that is proposed in the framework of investigating brain dysfunction or damaged brain function and has considered growth-oriented subjects. The same point is also important for brain damages; deeper qualitative changes caused by brain damage occur at younger ages. According to this view, injuries in early childhood usually have more serious effects (Ghasemzadeh, 2006). Studies in the field of cognitive problems consider the age of onset of epilepsy as one of the most important and influential factors affecting cognitive functions (van Rijckevorsel, 2006). This issue was also confirmed in the present research.

The prevalence and frequency of occipital and parietal lobe epilepsy are lower. Thus, there are an insufficient number of neuropsychological studies and comparison of these patients. Nevertheless, numerous neuropsychological researches have been carried out on patients with temporal and forehead lobe epilepsy. The findings have shown some difficulties in the memory of these patients. However, it is contradictory results. The findings of Delaney, Rosen, Mattson, & Novelly (1980) have shown that patients with temporal lobe epilepsy have some difficulties in the sub-sections related to visual and verbal memory, while patients with frontal lobe epilepsy illustrate a more ordinary performance in these tasks. However, Kemper, Helmstaedter & Elger (1992) did not find any differences between the two studied groups in terms of memory defect. In the present research, no significant difference was observed in visual memory

between the 3 epilepsy groups.

Some of the limitations of this research were the lack of control of the effect of factors like the type and dose of drugs, and frequency and intensity of convulsions on the amount of cognitive vulnerability. Therefore, it is recommended that future researches investigate the probability of the effectiveness of these factors. Furthermore, the investigation of the other cognitive fields in patients with epilepsy seems necessary. It is evident that many studies should be performed in order to illustrate the neuropsychological defects occurring in patients with epilepsy. It is hoped that this will result in acquiring further information in the field of cognitive performance of patients and providing appropriate assistance for assessing the education, improvement of QOL and social issues of patients, especially epileptic children.

Conflict of Interests

Authors have no conflict of interests.

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