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Opinion Article

The Effect of Epilepsy on Cognitive Functions

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Abstract

Cognitive impairment is observed in 30-50% of patients with epilepsy. Although epileptic seizures come to the fore in this disease, and they require priority treatment, seizures are relatively rare events. On the other hand, cognitive disorders (in cases where they occur) bother patients almost constantly. Taking into account the fact that currently, thanks to modern treatment, about two-thirds of patients with epilepsy can be free from epileptic seizures, it becomes obvious the importance of cognitive disorders in epilepsy, which are less treatable than seizures, and disturb patients significantly more often.

Keywords

Cognitive Disorders; Epilepsy; Cognitive Impairment; Temporal Lobe Epilepsy

Introduction

Cognitive (cognitive) functions are called brain functions, with the help of which the process of rational cognition of the world is carried out and purposeful interaction with it is provided: perception, processing and analysis of information, its memorization and storage, information exchange, construction and implementation of an action program [1]. Cognitive disorders

should be considered separately from mental disorders in epilepsy (epileptic psychoses, non-psychotic, mental disorders, dysphoria, twilight states, hallucinations, impulsive drives, delusional disorders, anxiety syndromes, obsessive-compulsive disorders, mood swings, etc.). There is no doubt that cognitive and mental disorders are interconnected and, of course, affect each other. Severe cognitive disorders of the brain, reaching the degree of mental retardation and dementia, will also not be considered in this article. They are characteristic mainly for patients with the onset of epilepsy in the first 5 years of life (especially in the first year), and mild dementia can be associated with the appearance of seizures at the age of 7 to 15 years. A high frequency of seizures (more than 1 per week) and the secondary generalization of epileptic seizures contribute to an increase in the severity of cognitive impairment [2].

The causes of cognitive impairment remain insufficiently studied. In epilepsy, there are three groups of factors that affect cognitive impairment:

- The etiology of epilepsy
- The effect of recurrent seizures
- The side effect of anticonvulsant therapy [3]

In an individual patient, the role of each of these factors is different, and the doctor is forced to choose between the anticonvulsant effect of the drug and the severity of its effect on cognitive functions. The need for compromise requires the ability to weigh and predict the importance of each of these factors for many years to come [4].

Observations show that the assessment of cognitive impairment by the patient himself often differs from the assessment obtained by an independent researcher [5]. This is especially true for memory. Interestingly, the degree of severity of memory disorders assessed by the patient himself correlates more with the severity of his anxiety and depression assessed by the doctor than with the scores on memory assessment tests [5].

Patients often use complaints of memory impairment to describe their most diverse cognitive problems [4,5]. However, it is possible that the discrepancies between the results of the researcher and the patient himself in assessing memory are due to the fact that the existing tests do not reflect enough those memory functions that are required in the patient's daily life, that is, those that are most important for him [6]. For example, such a discrepancy between the subjective and objective assessment of memory occurs in cases of memory loss for some individual past events of the patient's life (his meetings with relatives, important family or official events, trips to another city), which is often found in frontal epilepsy [6]. Such an "isolated" memory disorder in a patient causes misunderstanding and an unfriendly reaction from relatives or employees, since they are regarded by them as an offensive neglect on the part of the patient. The types of memory disorders vary very widely: difficulties in recognizing faces, forgetting simple words, inability to remember why you came to the kitchen, etc. From a neuropsychological point of view, these disorders are based on different cognitive mechanisms, but from the patient's point of view, this is generally reflected in his complaints about poor memory.

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Another circumstance that makes it difficult to assess cognitive impairments associated with epilepsy is that repeated epileptic seizures are often combined with severe brain damage and a decrease in intelligence as a result of these injuries. Therefore, there are significantly more patients with epilepsy among people with low IQ than in the general population. On the other hand, 20% of people with intellectual disabilities are diagnosed with epilepsy, which is associated in most cases with morphological brain damage. However, if we exclude patients with an IQ score below 70, the intelligence indicators of the remaining patients with epilepsy will be within the parameters of healthy people or slightly lower. Similar results were obtained in the distribution of patients with convulsive seizures caused by tuberous sclerosis according to the intelligence index (Fig. 1) [3].

The doctor always faces the question: are cognitive impairments a consequence of seizures, whether they existed before the appearance of convulsive or non-convulsive seizures, and also whether they are the result of side effects of medications. To address this issue, 155 patients with newly diagnosed epilepsy were examined before starting therapy in the SANAD study conducted in the UK. It was found that these patients are inferior to healthy individuals in terms of 6 out of 14 cognitive tests. Especially pronounced were the differences in memory indicators and the speed of psychomotor reactions. In this study, there was no dependence of the severity of cognitive impairment on the type of epilepsy or on the degree of reduced mood. The researchers concluded that a decrease in cognitive functions is characteristic of people who will later develop epilepsy, even before the onset of seizures, diagnosis and the beginning of the use of anticonvulsants. Another factor that leads to a violation of cognitive functions is depression. It is well known that depression is more common among patients with epilepsy than in the general population [1].

Traditionally, the decline in mood was attributed to psychologically understandable problems caused by this serious disease. In contrast to this opinion, it has recently been revealed that depression often precedes the appearance of the first attack and can be considered as a risk factor for the development of cognitive disorders before the onset of seizures and for the development of epilepsy later [6]. Hence the importance of early detection and treatment of depression.

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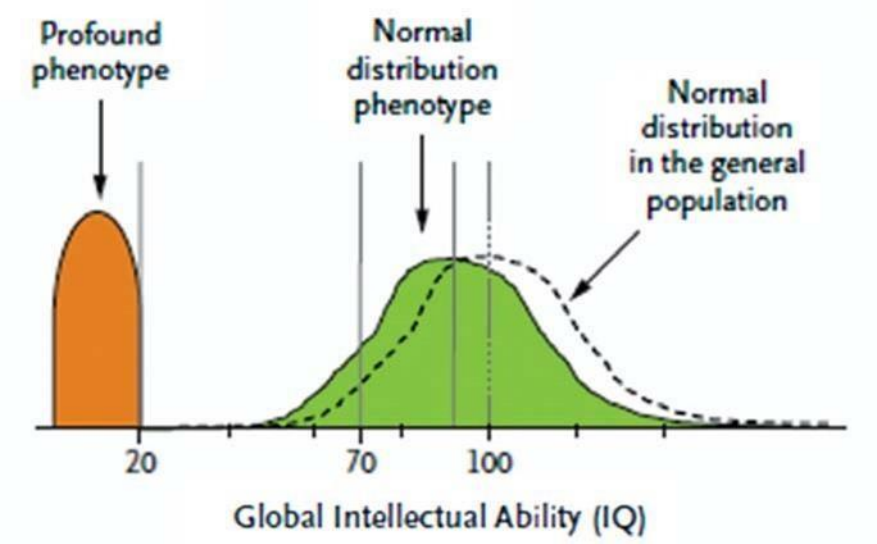

Figure 1: Indicators of intelligence quotient in patients with tuberous sclerosis and convulsive seizures.

The Effect of Localization of Brain Damage on Cognitive Impairment in Epilepsy

It was found that verbal memory is impaired with left-sided temporal focus, auditory-speech and long-term memory disorders are detected, while spatial and visual memory suffer with right-sided lesions [6]. In addition, it was found that the mental and intellectual abilities of left-handed patients are subject to a more pronounced decrease in comparison with right-handed patients.

There is evidence that diffuse epileptiform activity with bilateral synchronization on the EEG, indicating the dysfunction of non-specific median structures of the brain, has a more negative effect on cognitive functions than the presence of a lateralized focus of epileptiform activity in the cerebral cortex. This confirms the important influence of the localization of the focus of pathological activity on the severity of both the epileptic process and cognitive disorders.

Temporal Lobe Epilepsy

One of the most common injuries that is found in patients with focal temporal lobe epilepsy is hypocampal sclerosis. The decrease in results on tests of verbal learning and verbal memory directly correlated with a decrease in the volume of the hypocampus in the dominant hemisphere, determined by MRI. This correlation was confirmed in patients who underwent surgery: the density of removed hypocampal tissues positively correlated with the preoperative results of cognitive tests for verbal memory. In addition to the pathology of the hippocampus,

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the role of the cortex of the laryngeal parts of the brain in ensuring the functioning of memory mechanisms was also confirmed.

Over the past 50 years, it has been believed that verbal memory is associated with the medial structures of the dominant hemisphere, and nonverbal memory functions are associated with the median structures of the subdominant hemisphere. This dominant concept was based on the results of early surgical operations on these parts of the brain. However, now such specificity is being questioned. There are many cases described when verbal memory is impaired in patients with pathology in the right frontal lobe, and both verbal and non-verbal memory suffers in patients with damage to the left temporal lobe. In one of the most significant studies of specific cognitive disorders characteristic of patients with temporal lobe epilepsy, 96 patients were examined in comparison with a comparable group of healthy people. Only minimal cognitive impairments were detected in 47% of patients, and only memory impairments were detected in 24% of patients. In the remaining 29%, the disorders had a much wider spectrum and affected memory, attention, and the ability to perform tests for the speed of mental functions.

Great importance in the occurrence and nature of cognitive disorders in temporal epilepsy has recently been attached to the thinning of the temporal cortex and a decrease in the volume of subcortical structures: the hypocampus, thalamus, basal ganglia. It has been shown that patients with temporal lobe epilepsy suffer from such a cognitive function as emotion recognition. These studies were conducted using photographs that presented images of people's faces with an expression of bright emotions. The task of the subject was to recognize and name this emotion (fear, anger, sadness, disgust, happiness, surprise). In studies, it was found that patients with right-sided temporal epilepsy experience significantly greater difficulties than patients with left-sided temporal epilepsy, although the cognitive performance of patients with left-sided temporal epilepsy was also worse than in healthy individuals.

Frontal Epilepsy

It is believed that patients with frontal epilepsy are characterized by similar results of tests for studying memory and learning ability to patients with temporal epilepsy [2]. However, in qualitative terms, violations in the two groups still differ. Patients with frontal epilepsy are characterized by difficulties in arranging past events in the correct sequence and in being able to determine the correct time when these events occurred. Confabulations and pseudo-reminiscences often occur in such patients and can replace gaps in memory if the patient cannot remember accurate information. Patients with frontal epilepsy are able to accurately retell the story they have just heard, unlike patients with temporal epilepsy, who are not able to reproduce many details of such a story. However, patients with temporal lobe epilepsy are always aware of the weakness of their memory, unlike patients with frontal epilepsy. The problem with memory in patients with frontal epilepsy is associated with their inability to determine the source of information: where, when and how they received this information [2,4].

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In the study, which was supposed to show that memory suffers more in patients with temporal epilepsy, and performing functions suffer more in patients with frontal epilepsy, no significant differences were found in these indicators [4]. Perhaps this was due to the fact that the tests used were not related to paper and pencil, but copied the tasks of everyday life. In both groups, there was a decrease in memory, but the performing functions in everyday life were within the normal range.

Additional Factors Affecting Cognitive Impairment

Currently, there is more and more evidence that with the same localization of the lesion, there may be significant differences in the degree of cognitive impairment. So, if a Dysembrioplastic Neuroepithelial Tumor (DNET) or another form of cortical dysplasia appears at very early stages of a child's development, it will cause relatively small cognitive problems. But if a rapidly growing tumor appears in an adult, then the cognitive impairments that have occurred can be very significant. Thus, similar injuries in localization and size have very different effects on cognitive functions in different patients [2].

Great importance is attached to gender differences in cognitive abilities. The deterioration of verbal memory in women suffering from epilepsy does not disrupt their daily life as much as it happens in men, due to the fact that the verbal abilities of women in the population are higher on average than in men. Women suffering from epilepsy also remember faces better than men [2]. Together, these factors help them in the case of cognitive impairment in epilepsy [2,5]. At the same time, it is described that women suffering from left-sided hypocampal sclerosis have more pronounced cognitive impairments than men [2]. It was also shown that the indicators of non-verbal communication are worse in men, and this is consistent with the data on the more frequent detection and severe nature of this kind of cognitive impairment in men compared to women.

The frequency, type and age of onset of seizures are also factors that have a significant impact on the patient's cognitive abilities [1]. Several studies have shown that the early onset of seizures, especially their onset before the critical period (approximately up to 5 years) it is typical for patients who cannot distinguish the emotional state of a person by the face in the photo. For example, patients with right-sided temporal lobe epilepsy and early onset of seizures were significantly worse able to recognize the emotion of fear compared to the control, in contrast to patients with the same damage, but with late onset of seizures [5]. Interestingly, this study showed that difficulties in recognizing emotions relate more to the expression of such negative emotions as fear, sadness, disgust.

The clinical course of epilepsy affects cognitive functions and the results of their research. Serial seizures that took place shortly before the neuropsychological examination, nighttime sleep-disrupting seizures, subclinical intercalative changes on the EEG-all these factors can worsen the performance of cognitive tests. The presence of attention deficit hyperactivity

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disorder in the patient (which is currently quite common) it also affects the effectiveness of cognitive processes and test results [1]. Depression and anxiety (including situationally conditioned ones), often combined with epilepsy, also impair memory and the ability to concentrate and learn. Alcoholization of patients with epilepsy and patients with chronic alcoholism who suffer from convulsive seizures has a significant impact on cognitive functions. Low mood and low self- esteem worsen objective memory indicators and, moreover, the subjective perception of such problems by the patient [3]. In this regard, it was found that the patient's perception of his cognitive difficulties correlates with the indicators of his quality of life more than with the results of objective cognitive tests.

Although cognitive impairments may precede the onset of convulsive seizures, convulsive seizures themselves can also lead to their gradual increase. The epileptic status and the associated death of neurons can lead to irreparable cognitive disorders. Generalized convulsive seizures, repeated head injuries associated with falls during an attack, frequent "drop attacks" also gradually worsen cognitive functions. On the other hand, partial seizures do not seem to accelerate the natural age-related weakening of memory and attention [3,6].

Conclusion

In conclusion, we can cite the results of the study, which once again shows that cognitive disorders worsen the quality of life of patients no less than convulsive seizures. For example, it was found that memory disorders have a greater impact on lowering the socio-economic level of the patient than the stigmatization associated with the diagnosis of "epilepsy" and then intellectual weakening. The inability to remember the name of a close acquaintance, forgetting important events for the surrounding people are perceived by relatives as indifference or malevolence, and gradually narrow the circle of acquaintances of the patient, which reduces the patient's quality of life leads to social isolation and further stigmatization and this, in turn, worsens cognitive functions or, at least, their subjective perception by the patient himself.

The presented literature review shows that at the present stage of epileptology, when effective drugs for the treatment of epilepsy have already been created and two-thirds of patients can be free from seizures, the task of treating cognitive disorders in patients becomes very urgent. It is recognized that these disorders play an important role in the life of patients. The impact on cognitive functions becomes the most important indicator when introducing new anticonvulsants, which indicates the great importance of this problem and its awareness by doctors and patients. However, there are still not enough methods to combat cognitive impairment. Methods of neuropsychological rehabilitation for cognitive disorders (teaching patients mnemonic rules, etc.) are still not effective enough. Therefore, it can be assumed that the creation of new drugs is required to correct cognitive disorders associated with epilepsy.

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