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Research Article

# COGNITIVE IMPAIRMENT AND THE IMPACT OF INTERHEMISPHERIC ASYMMETRY ON THE COURSE OF STRUCTURAL EPILEPSY

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## ABSTRACT

A study of patients suffering from structural epilepsy was carried out taking into account the state of the cognitive sphere and lateralization of the epileptogenic focus. It was found that the development of cognitive dysfunction was related to a number of factors. The neurophysiological researches have shown causality of cognitive disorders with functional changes of bioelectrical activity in certain parts of the brain.

## KEYWORDS

Structural epilepsy, cognitive function, lateralization of epileptogenic focus.

## INTRODUCTION

A variety of cognitive deficits, along with the severe clinical manifestations of symptomatic epilepsy, contribute to the disability and stigmatization of patients in their environment. Stigmatisation, according to many researchers, is a barrier to improving quality of life, which has a significant impact on the personality, mood and behaviour of patients with this form of epilepsy.Modern advances in the diagnosis and treatment of epilepsy, with the use of effective anticonvulsants, leads to a decrease in the proportion of psychoemotional disturbances and seizure equivalents, increasingly described in resistant forms of the disease and an increase in moderate cognitive impairment. The latter are no less in urgent need of timely detection and correction to prevent the buildup of the defect and improve the quality of life of patients with structural epilepsy.

The contribution of antiepileptic therapy to the development of cognitive dysfunction cannot still be underestimated, as a particular feature of treatment is the need for many years, sometimes for life, of

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antiepileptic drugs (AEDs), which lead to side effects and complications in 25% of cases.

The influence of functional asymmetry on the course of patients with symptomatic epilepsy has recently been the subject of much discussion. The influence of epileptic lateralization on the course and efficacy of therapy in patients with epilepsy is less well studied, and the topic of cognitive impairment in the context of functional asymmetry in patients with this pathology has been neglected.

The aim of the study was to investigate the effect of lateralization on the course of epilepsy and on the development of cognitive impairment.

MATERIAL AND METHODS: The study included 72 patients diagnosed with structural epilepsy. The main group consisted of 47 patients with epilepsy with cognitive impairment. The comparison group included 15 patients with epilepsy without cognitive impairment. The control group included 10 healthy subjects, who were comparable to the main group in demographics and level of education. The following methods were used: clinical-neurological, neuroimaging, and neurophysiological. The classification of epilepsy (New Delhi, and epileptic seizures (Kyoto, Japan, . The NHS3 (National Hospital Seizure Severity Scale) (O'Donoghue M.F. etal., . The level and structure of intelligence was assessed using neurocognitive tests - standard test sets of scales with formalized (quantitative) assessment of results - MMSE, Mini-cog, Moco -test, frontal dysfunction battery. The individual profile of the lateral organization of the functions (in the "hand-ear-eye" system) was assessed (Chomskaya E.D., Efimova I.V. et al., 1997). The leading importance was given to the motor sphere, i.e. the leading hand.

Results and discussion: Analysis of the characteristics of the epileptic process influencing the appearance of a cognitive disorder revealed the following factors to be of most importance. Age of seizure onset had a strong influence on cognitive functioning. In moderately severe dementia, the minimum values of the MMSE, Mini-cog tests were observed in patients with seizure onset before 5 years of age ($p<0.03$). Half of the patients in this group (52.94%) had a first-year onset of epilepsy, a further quarter (23.52%) had seizures before their fifth birthday, and no cases had onset above the age of 13 years were identified. In mild dementia and mild cognitive impairment, minimal scores on the MMSE, Mini-cog tests were observed in patients with seizure onset between the ages of 11 and 15 years ($p<0.009$ and $p<0.0003$, respectively).

The duration of structural epilepsy had a mixed effect on the cognitive domain. In the group with developmental cognitive impairment, the duration of seizures decreased with increasing age of seizure onset (from 3.8 years for moderate dementia to 13.8 years for mild cognitive impairment), from 21.9 years to 13.3 years. At the same time, in the comparison group of patients with structural epilepsy without cognitive impairment, at the latest possible age of seizure onset (16.6 years), the duration of the disease corresponded to the group with dementia. This may be due to the peculiarities of the premorbid level of intelligence and the degree of brain maturity at the onset of the disease. It has been found that in patients with premorbidly high intelligence, cognitive decline is revealed to a lesser extent, later and better compensated.).

The analysis of the social functioning of the patients studied has confirmed the opinion of most researchers, that with the course of the epileptic process, the quality of life of the patients suffers more

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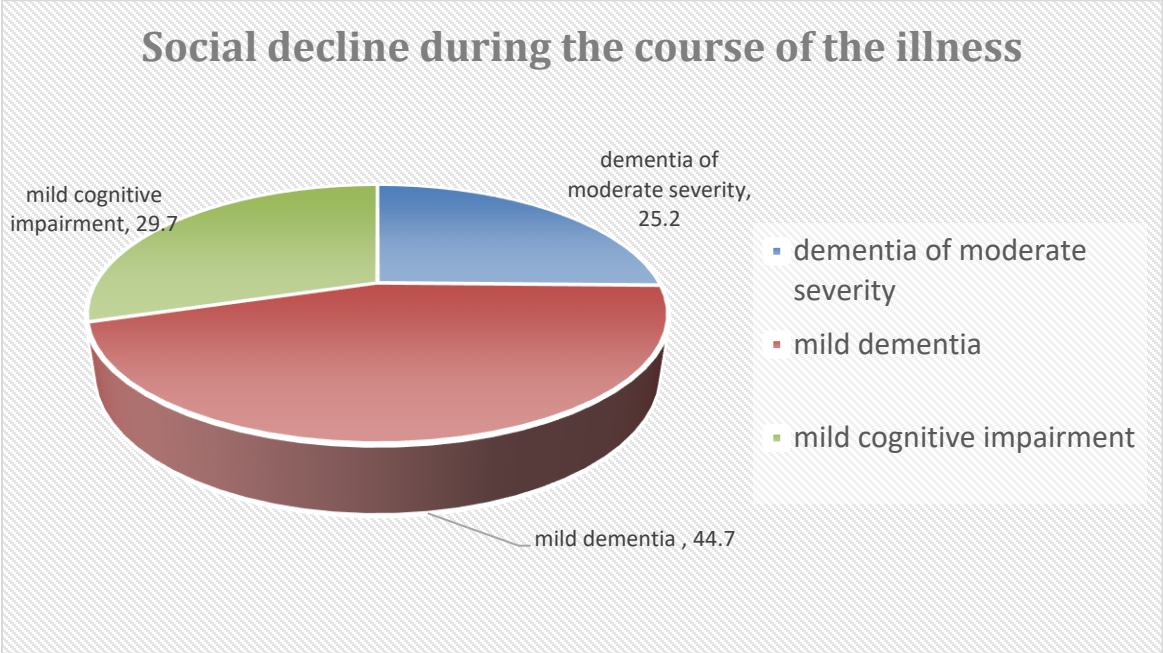
from psycho-emotional and neurological disorders. Cognitive and emotional disturbances are in the foreground.

During the course of the disease, 59.6% of patients (28 people) in the main group lost their qualifications or work. The majority of patients suffering from a loss of social status (loss of job or qualifications, loss of independence in self-sufficiency) had impairments reaching a medium degree of dementia - 12 patients (25.5%) of the subgroup. With a mild degree of dementia, a decrease in social status was noted in 21 to 44.7% of patients, and with a mild cognitive disorder in 14 to 29.7% of patients (Figure 1).

Proportion of epilepsy patients with decreased social status (%)




In the group without cognitive impairment (control group), the percentage of patients who reported a decrease in social status in connection with the disease was also high - 70%. The decline was due to impairments in the personal and emotional spheres.

Patients with intermediate degree dementia were distinguished by diffuse slow-wave activity on EEG with bilateral synchronous flashes indicating dysfunction of medial brain structures, while amplitude accent in left temporal area was associated with statistically significant decrease of cognitive functions (16,88±4,22 points versus 18,80±5,06 points with right accent), ($p<0,04$). At the same time, patients with localized epileptiform activity had higher test scores - 20.83±2.92 for left temporal focus and 20.66±3.78 for right.

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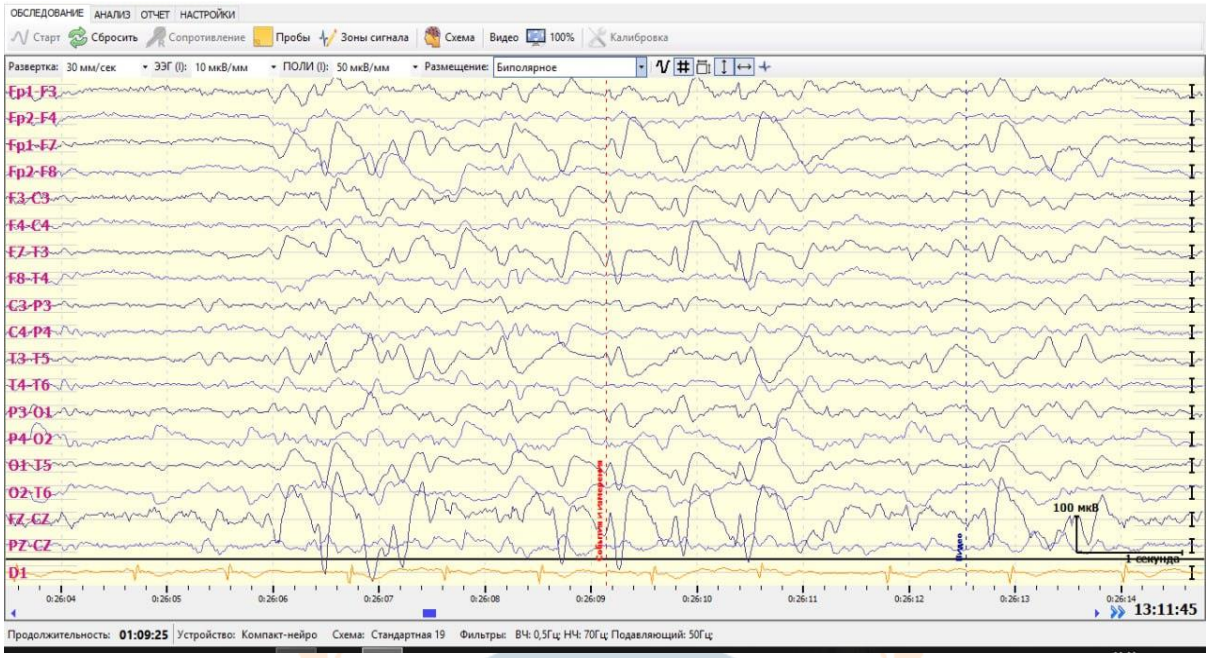


**Fig. 1. EEG fragment of patient A. 35 years old.**

This EEG epoch registers epileptiform activity in the drowsy state in the form of transient regular slow waves and "sharp slow wave" complexes with amplitude up to 150μV, frequency 1.5Hz in the left temporal region. (EEG provided from personal archive of Klycheva R.I.)

Thus, the presence of diffuse slow-wave activity with bilateral synchronization, indicating dysfunction of nonspecific medial brain structures, was more reflected in the cognitive sphere than the presence of a lateralized focus of epileptiform activity in cortical dysfunction.

Patients with mild dementia were distinguished by the presence of regional epileptiform activity in the left frontotemporal region, which led to a statistically significant reduction in cognitive function ($p<0.01$, $t=-2.46$). Similar focal epileptiform activity but with a focus in the right temporal region correlated with mild cognitive impairment ($p<0.005$, $t=-2.88$).

Among other factors of the epileptic process, high frequency of seizures (more than 1 per week) ($p<0.03$), seizures with secondary generalization ($p<0.02$), and symptomatic form of epilepsy ($p<0.003$) had a significant impact on the cognitive sphere.

Along with this, the cognitive sphere of patients with epilepsy was studied taking into account functional asymmetry, in particular its motor component.

The study group included 16 (34.1%) patients with left-handed motor asymmetry and 31 (85.7%) with right-handed asymmetry. The comparison group was entirely represented by right-handed individuals. In the control group, among healthy subjects, the same figures were 5% and 95%, respectively. This generally agrees with the data given by most authors (Dobrohotova H.H., Bragina T.A., 1994). Epilepsy patients with left-sided motor asymmetry had a heterogeneous structure in terms of hand genesis with compensatory causes (due to pathology of delivery

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with fetal extraction, bilateral otitis media, complicated neuroinfections, craniocerebral injuries and infectious brain diseases with formation of right-sided hemiparesis - 37.5%) and hereditary causes (62.5%).

Thus, it is possible that the high prevalence of left-handed people among patients with epilepsy is determined, in addition to hereditary cases, by a significant proportion of individuals whose pathological processes of the brain lead to compensatory activation of right hemisphere functions with the development of left-sided motor asymmetry.

The high frequency of seizures (more than 1 per week) in patients with the left hand led to a statistically significant decrease in memory function ($p<0.04$, $t=-2.23$) and in those with the right hand - in hand-eye coordination ($p<0.01$, $t=-2.40$).

## CONCLUSIONS

1. In structural epilepsy, along with psycho-emotional disturbances, cognitive dysfunction of varying severity from mild cognitive impairment to dementia of moderate severity occurs.

2. Cognitive impairment in structural epilepsy may be associated with both the duration of the disease, the age of onset of the epileptic process, and the features of premorbid level of intelligence and degree of brain maturity at the onset of the disease.

3) The presence of diffuse slow-wave activity with bilateral synchronization, indicating dysfunction of nonspecific medial brain structures, was more likely to affect the cognitive domain than the presence of a lateralized focus of epileptiform activity in cortical dysfunction.

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