ESTIMATION OF FUNCTIONAL STATE OF CNS USING EEG OF PATIENTS WITH ATRIAL FIBRILLATIONS

Sadullayeva Shamsiyobu Muhiddinovna,
student of Samarkand State Medical University
Alimova Zulayho Kuvondikovna,
student of Samarkand State Medical University

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As is known, atrial fibrillation (atrial fibrillation (AF)) leads to circulatory disorders, changes in the functional state of the central nervous system and, in some cases, to ischemic stroke. At the same time, there is a connection between the duration of heart rhythm disturbances (that is, the constant or paroxysmal form of AF) and the degradation of the higher functions of the central nervous system [1]. In this regard, for patients with MA, it is important to assess the functional state of not only the cardiovascular system, but also the nervous system. At the same time, identifying changes in electroencephalogram (EEG) patterns in heart diseases, as well as in vascular diseases of the brain, is difficult due to the lack of EEG specificity in such patients. The use of functional loads in these cases can help identify the degree of pathological manifestations in the central nervous system and evaluate the restructuring of the electrical activity of the brain in accordance with a frequency equal to or a multiple of the frequency of light pulses. As is known, the severity of such a restructuring is determined by the excitability and lability of cortical neurons, which depends on the ratio of the activating H and deactivating influences of the Co side nonspecific brain systems.

20 patients with atrial fibrillation (AF) were examined. Of these, 10 people were diagnosed with a permanent form of MA and 10 with a paroxysmal one. All patients were characterized by complaints of pain in the heart, headaches and memory loss. The EEG was recorded with an electroencephalograph at rest and during functional load (rhythmic photostimulation). Reactive patterns were analyzed using wavelet analysis [3] and recurrent analysis [4], which made it possible to quantify the dynamic changes occurring during photostimulation and calculate the coefficients of rhythm acquisition in different frequency ranges. The absence of an assimilation reaction was assessed by the absence of an increase in the energy of the wavelet spectrum near the frequency of the light signal and the absence of simultaneous recurrences in the joint recurrence diagram of the EEG pattern and the light signal. The degree of assimilation was determined using the coefficients of rhythm assimilation and retention, as well as the

time of its memorization, calculated on the basis of wavelet analysis of reactive EEG patterns.

The results obtained show that patients with cardiovascular pathology in the form of MA are characterized by assimilation of the proposed rhythm in a very narrow frequency range (10–12 Hz). At the same time, in persons with a paroxysmal form of MA, the values of the coefficients of rhythm assimilation and retention are higher than in persons with a constant form of MA. Thus, for the first group of patients a slow and strong reaction was observed in assimilating the rhythm of alpha frequencies, while for the patients of the second group a significantly weaker reaction was observed. It is known that in patients with vascular pathology of the brain in the form of vegetative-vascular dystonia or vertebrobasilar insufficiency, there is a strong reaction to the assimilation of rhythms not only of alpha, but also of the theta and beta ranges, and healthy people are characterized by a slight assimilation of frequencies of the alpha range [5] . The absence of a rhythm assimilation reaction, associated with the absence of an increase in the energy of the wavelet spectrum near the photostimulation frequency, characteristic of healthy individuals, reflects the predominance of internal synchronization of neural structures when an external rhythm is imposed. The presence of a reaction of assimilation of a rhythm of a given frequency in patients with the paroxysmal form of AF indicates an increase in the instability of internal synchronization and an increase in external synchronization. A weak response in patients with a permanent form of MA may be associated with a decrease in the excitability and lability of cortical neurons due to chronic brain hypoxia. Thus, our results indicate the ability of nonlinear dynamics methods to reliably assess differences in the functional state of the central nervous system not only in patients with vascular pathology of the brain, but also with cardiovascular diseases in the form of atrial fibrillation arrhythmias of paroxysmal and permanent type.

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