Opiate Abstinent Syndrome Is Rapidly Blocked by Electrostimulation

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Abstinent syndrome is a painful condition occurring in drug addicts after cessation of drug intake. It is characterized by a broad spectrum of subjective and objective pathological conditions associated with the brain and other systems of the organism. We attempted to avoid severe complications occurring as a result of treatment of opiate abstinent syndrome (OAS) with medications or by extracorporal detoxification. For this purpose, we proposed to relieve OAS with the use of transcranial brain electrostimulation with weak unipolar impulse current, which makes it possible to change the pathological homeostasis of the brain of drug addicts [1]. This approach has a pronounced positive psychotropic effect. However, it has not always been successful in removal of the somatovegetative disorders and discomfort characteristic of OAS.

A possible reason for insufficient therapeutic effect of electrostimulation in OAS treatment may be the use of unipolar impulse current. The latter predominantly exerts a hyperpolarizing effect and does not ensure disturbance of the extracellular matrix components in the brain, the corresponding change in the functional state of nerve cells, and the therapeutic effect that weak bipolar impulse current exerts in stroke, prosopalgia, and infantile cerebral paralysis [2-4]. Another possible reason is that central mechanisms do not underlie all pathologic OAS manifestations, and it is necessary to affect not only the brain, but also other systems of the organism, whose disorders in OAS are the most pronounced and most frequent. In OAS, these are cardiovascular disorders and pain in the muscles, bones, and joints.

We showed that the treatment of acute heart lesion with the use of transcranial electrostimulation [5] and algias of different genesis [4] (prosopalgia, in particular) using targeted electrostimulation was successful. For this reason, we attempted to use this method for changing and increasing the areas affected by electrostimulation in drug addicts so as to rapidly eliminate OAS without or with minimum medications, because they exert undesirable effects on psychological processes, thereby hampering the evaluation of cognitive deficit in drug addicts after the OAS elimination. The new combination of areas subjected to electrostimulation and the change in the characteristics of the current used in electrostimulation were more effective in OAS treatment and allowed us to perform preliminary examination of the cognitive abilities of drug addicts (when not in the drug addiction state). The results of these studies are described below.

The effects of electrostimulation were evaluated in 12 males aged 17-35 years who took different forms of opiate drugs for three to seven years and who was hospitalized to treat drug addiction. Unlike our previous study [1], transcranial electrostimulation was performed only at one position by placing one electrode on the forehead and the other on the back of the head. For electrostimulation, we used bipolar asymmetric impulse current (frequency, 300-500 Hz; current strength, 100–500 μ A; duration, 5 min). In addition to transcranial electrostimulation, we also used transthoracic electrostimulation [5] so as to attenuate cardiovascular disorders, enhance the soporific effect [5], and remove anxiety [6]. Muscle, bone, and joint pains were relieved by placing one electrode on the lumbar region and the other on the painful area of the lower extremities. For this purpose, we used impulse current, individually varying its strength, frequency and impulse duration until the patient had noticeable sensations. In addition to the conventional scheme of clinical examination, the patients' mental status was evaluated before electrostimulation. We took into consideration their appearance, behavior, memory, mood, etc. [7], as well as their attitude to this procedure, their sensations during and after electrostimulation, and their personal estimation of the electrostimulation usefulness for eliminating OAS.

Transcranial electrostimulation at only one electrode position did not weaken its psychotropic effect in

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the patients. As in the procedure used previously [1], it had pronounced anxiolytic, antidepressant, soporific, and sedative effects. The use of two new positions in electrostimulation ensured an immediate pain relief and significantly decreased the anxiety, which is largely determined by cardiovascular disorders [5, 6]. Note that it is physiologically important to start the procedure with pain relief and finish it with transcranial electrostimulation. During the first procedure, the patients became somnolent. After a long day sleep, they awakened in a good mood without complains for residual manifestations of OAS and did not apply for additional pharmacotherapy. Only their heart rate slowly restored to the normal level. Due to these rapid changes in the state of the drug addicts, it was not necessary to use any quantitative scale for evaluation of the abstinence dynamics. The changes were especially pronounced in those patients who were hospitalized in poor condition. As soon as after the first procedure, some patients thought that OAS had been completely eliminated and wanted to leave hospital saying that they would be able to return to their job. Usually, the patient had as many as three procedures at two-day intervals. If muscle, bone, and joint pains disappeared after the first procedure, the patients subsequently received only transcranial and transthoracic electrostimulation. It is noteworthy that the patients themselves asked for transcranial electrostimulation, emphasizing that it improved their state.

Thus, we demonstrated the principal possibility of a rapid block of OAS without pharmacotherapy (to say nothing of detoxification) that affects the mediator systems of the brain and, therefore, without complications. The possibility of pain relief in OAS prior to the transcranial stimulation confirms our assumption that not all manifestations of OAS are of central origin.

When OAS has been eliminated, the next problem in the treatment of drug addiction is a complete elimination of the drug dependence. As a result of attempts to understand the cause of the irresistible addiction for drugs, the attention of the researchers has been focused on the brain reinforcement system for many years. The difficulties of restoration of psychical and social independence in drug addicts after several years of drug use remain insuperable. This is apparently associated with damage of many areas in the brain and changes in personality. It can be a priori suggested that, in addition to the limbic system, disorders in the dopamine neurotransmitter system in drag addicts should also affect the mesocortical system. It is known that the prefrontal cerebral region, which is a part of this system, is responsible for realization of the human cognitive abilities, one of the highest manifestations of which is executive functions (such as planning, conceptual thinking, problem solving, selection, control, etc.) [7, 8]. The estimation of the executive functions with the use of three tests revealed their dramatic disruption in drug addicts. In the first test, the patients composed new words from the letters constituting their names or the names of their parents. In the second test, the patients had to determine the identity of shifted cards with four semicircles on them by mentally rotating the cards. The third test was to find the rule for determining the direction of movement of two groups of trains shown in the picture [9].

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Within several minutes, the patients could compose no more than three or four new words in the first test. They even did not try to perform the second and third tests, which seemed too complicated to them. For comparison, the first and second tests can be easily performed by 12- to 13-year-old adolescents, and the third test was interesting for them even after numerous unsuccessful attempts to perform it.

These tests revealed cognitive deficit in the drug addicts, which is expressed as their inability to recite the Russian alphabet; to multiply numbers 7, 8, and 9; to sum up two-digit numbers, and to memorize quatrains. Therefore, it was of interest to trace the dynamics of the cognitive deficit during the next two to three months after OAS elimination and cessation of drug use in two patients (by their consent), who stayed in the hospital and had electrostimulation procedures twice a week. During this period, the general state and the memory of the patients improved. One of them could exactly repeat a complex sentence of 20 words dictated to him; however, he had difficulties with memorizing poems. The patients adapted to the stay in the psychiatric hospital; however, during their hospitalization, they still failed to perform the tests offered earlier and did not took initiative in restoring their social independence, gaining new working skills, or retraining, despite the fact that they were regularly asked questions about their life after leaving the hospital and received help in solving their problems. They were prepared to continue staying in the hospital but saw neither purposes in their life nor the ways of self-renewal.

In conclusion, we would like to stress that the rapid OAS block in drug addicts by means of electrostimulation without complications and practically irreversible cognitive deficit for two to three months (after the OAS elimination and cessation of drug use) suggest that these pathological manifestations are related to different brain structures and functional processes. The impairment of declarative and short-term memory and executive functions in the drug addicts studied may be explained based on the "coherent neuron ensemble" hypothesis put forward by Paller [10] for description of the model of memory consolidation. According to his model, a coherent ensemble is a functional association of different brain regions responsible for storage of declarative memory, which is formed in the course of extracting the required information. In amnesia, the coherent ensemble is not formed, leading to declarative memory impairment. Similarly, it can be assumed that executive functions are related to the appearance of a coherent ensemble of different regions of the prefrontal cortex. The defects in its formation in drug addicts cause the impairment of their cognitive abilities.

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