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# CORRECTION OF SPEECH AND AUTONOMIC DISORDERS AFTER THE ISCHEMIC STROKE

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# КОРРЕКЦИЯ РЕЧЕВЫХ И ВЕГЕТАТИВНЫХ РАССТРОЙСТВ ПОСЛЕ ИШЕМИЧЕСКОГО ИНСУЛЬТА

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Investigation of 106 patients in the early recovery period of an ischemic stroke is conducted. Autonomic nervous system dysfunction, speech problems and the psychoemotional disturbances are revealed. Strong correlation of aphasia and depression was demonstrated. Efficiency of an antioxidant treatment in correction of the revealed problems at the patients with an ischemic stroke is shown.

*Keywords: ischemic stroke, autonomic dysfunction, aphasia, dysarthria*

Проведено исследование 106 пациентов в раннем восстановительном периоде ишемического инсульта. Выявлены дисфункция вегетативной нервной системы, речевые проблемы и психоэмоциональные нарушения. Была продемонстрирована сильная корреляция афазии и депрессии. Показана эффективность антиоксидантного лечения при коррекции выявленных проблем у пациентов с ишемическим инсультом

*Ключевые слова: ишемический инсульт, вегетативная дисфункция, афазия, дизартрия*

In Russia more than 650000 people suffer a stroke each year, and approximately two-thirds of these individuals survive and require rehabilitation. The goals of rehabilitation are to help survivors become as independent as possible and to attain the best possible quality of life. Even though rehabilitation does not «cure» the effects of stroke in that it does not reverse brain damage, rehabilitation can substantially help people achieve the best possible long-term outcome [1, 6].

The ischemic stroke is an accident, which, at a favorable outcome, leads to cardinal changes in human life and his relatives [12]. There is no patient without these changes in a way of life, mood and behavior. At the same time traditionally in a clinical picture of a stroke the main influence is given to the focal neurologic deficiency bound to a physical disability, first of all to disturbance of motor function. Meanwhile the psychoemotional disorders, speech problems and dysfunctionof autonomic nervous system arising at appreciable number of the poststroke patients, render on household, social and professional adaptation nearly larger effect, than motor deficiency and become an important problem [8, 11].

Changes of autonomic regulation in case of acute brain ischemia are including both direct damage of the suprasegmental centers, and the neurometabolic shifts caused by stress factors. The deviations, arising in the regulating parts of the autonomic nervous system precede hemodynamic, metabolic, respiratory disturbances and, thus, can be the most valuable prognostic symptoms of the patient after the stroke [5].

In a number of scientific issues was shown that at the differentiated studying of autonomic disorders depending on localization of the stroke, patients with right-sided process have vagotonic disturbances with depression of a tonus of veins, arterioles more often, and also with activation of a limbic system [2, 9, 10, 13]. In patients with the stroke in the left hemisphere the simpaticotonia with increasing of peripheral resistance of vessels, a vascular tonus, difficulty of venous outflow was observed [6].

The most expressed and, at the same time, well studied disturbances of an autonomic regulation are cardiovascular disorders. But disorders of the thermoregulation, the hyperventilation syndrome, dysfunction of gastro-intestinaltract, various forms of insomnia which are also reflecting a systemic disorder in case of brain infarcts are not less importantand influence quality of life of the patient after the stroke [4].

Disorders of autonomic nervous system in combination with other symptoms of neurologic deficiency change psychoemotional background of the patient [3]. But, besides, the role of the deficiency of the most important neurotransmitters arising in case of ischemic injury of a brain is undoubted in emergence of alarming and depressive disturbances at this group of patients [7]. And different type of aphasia, what can be found in more than one third of the patients after the stroke, decrease the quality of life and increase the level of disability of poststroke patients. Problems with speech involve the ability to speak, write, and understand spoken and written language. A stroke-induced injury to any of the brain's language-control centers can severely impair verbal communication. Patients with motor aphasia have difficulty conveying their thoughts through words or writing. They lose the ability to speak the words they are thinking and to put words together in coherent, grammatically correct sentences. In contrast, receptive aphasia causes difficulty understanding spoken or written language and often hasincoherent speech. Although patients can form grammatically correct sentences, their utterances are often devoid of meaning. The most severe form of aphasia, global aphasia, is caused by extensive damage to several areas of the brain involved in language function [14]. People with global aphasia lose nearly all their linguistic abilities; they cannot understand language or use it to convey thought. All these conditions strongly influence social activity, level of independents and emotional state of the poststroke patients.

**Material and Methods.** For studying of prevalence, degree of expression and a possibility of correction of autonomic dysfunction, speech problems and psychoemotional disturbances at patients in the early recovery period of an ischemic stroke we examined 106 patients undergoing treatment in Volgograd regional hospital №1. Average age of patients was 63.4±2.4 years, 32 men and 74 women. The research criteria include the patients who received from 0 to 4 points on Renkin's scale without the severe disturbances of cognitive function. The following research methods and tools were applied: CT/MRI diagnostics, clinical neurological examination, the Rivermid mobility index, the MMSE cognitive impairment scale and the aphasic test. For studying of autonomic dysfunction we used the questionnaire on identification of signs of vegetative disturbances; access neuromuscular excitability. Psychoemotional features of patients were studied by Spilberger's and Beck's tests.

Patients were divided into three groups: 33 patients with aphasia, 37 people with dysarthria and 36 patients without speech disorders. The groups were comparable in gender and age compound.

Further treatment, according to references of National leaders on a neurology (2009), including an antioxidant – Mexidol in a dose of 125 mg 3 times a day within 2 months was carried out. The choice of drug was bound to existence at it the multimodal action caused by its structure: its pharmacological formula contains a metabolite of a cycle of tricarboxylic acids. Mexidol's ability to improve a brain metabolism, due to optimization of work of a respiratory chain of mitochondrial system that promotes stabilization of a cellular membrane, to decrease of a post-hypoxemic metabolic acidosis, activation by anaerobic products of macrophages against the background of deficiency of oxygen is actively used by neurologists as in treatment of the acute and recovery periods of a stroke.

The processing of statistical data was conducted through the means of parametric and correlation methods. The statistical analysis was carried out with the Statistica 5.0 and the Microsoft Excel 2003. Level of statistical reliability of data was accepted at p<0.05.

**Results and Discussion.** In the first group Rivermid mobility index was 4.6±0.9. But evaluation of the emotional changes was poor, because of the difficulties in contact establishment with patients, as they had sensory and sensor-motor aphasia. However, indirect signs of depressive manifestations were common among the patients (83 %): refusal to eat, refusal to take medicines, restriction of contact with relatives and medical personnel, presence of frontal lobe lesion symptoms. In this group strong correlation of r=0.67 was found between the motor disorders and depressive manifestations.

In a group of patients with dysarthria there were determined index of motor disorders of 4.3±0.6. Also indirect signs of depressive manifestations (36 %) were found. In this group, there was a strong correlation (r=0.78) between the indicators of mobility index and the presence of depression on the Beck's test. The medium correlation between cognitive and motor impairment was determined (r=0.54).

In the group without speech disorders, the medium value for the depression scale was 9.1±0.8 points, and the Rivermid mobility index was 4.8±0.9 points. The level of indirect signs of depressive manifestations was 20 %.

All examined patients transferred the acute disorder of a cerebral circulation on ischemic type verified with CT or MRI. 45 patients (42.5 %) had ischemic lesion in left middle cerebral artery area, 33 (3.11 %) – right middle cerebral artery area, at 28 (26.4 %) – in the vertebro-basilar area.

Representation of complaints of the examined patients to various implications which can be regarded as vegetative dysfunction is shown by Table 1.

*Table 1*

**Variety of complaints in patients in the early recovery period of an ischemic stroke**

| Complaints | Patients | |
|---|---|---|
| | Number | % |
| Feelings of shortage of air | 27 | 25.5 |
| Feelings of insufficiensy of breathing | 32 | 30.2 |
| Hyperhydrosis | 12 | 11.3 |
| Inflows of heat or cold | 11 | 10.4 |
| Feeling of anxiety or fear | 78 | 73.6 |
| Irritability and aggression | 43 | 40.6 |
| Headaches | 79 | 74.5 |
| Dizziness | 52 | 49.1 |
| Malaise | 14 | 13.2 |
| Fatique and weakness | 89 | 83.9 |
| Tachycardia | 61 | 57.5 |
| Paraestesia in extremities | 59 | 55.7 |
| Abdominalgia | 15 | 14.2 |
| Insomnia | 62 | 58.5 |

Average values of reactive and personal uneasiness according to Spilberger and Beck's tests demonstrate appreciable disturbances in the psychoemotional state at the examined patients. The number of points on a scale of personal uneasiness on average 44.1±0.53 that show predilection of patients to perceive a big amount of situations as menacing. Values on a scale of reactive uneasiness reached 48.3±0.81 points that characterizes the raised strain and feeling of concern and shows prevalence in the psychoemotional state of alarming implications. Substantial increase of indicators according to Beck's test on average to 22.7±1.21 demonstrates existence of depressive disturbances of appreciable degree of expression. At the same time it is necessary to notice that only at 7 patients (6.6 %) points of personal and reactive uneasiness corresponded to the moderate level, which is conditionally taken for a normal indicator. According to Beck's test, the absenceof depression occurred even less often – at 4 patients (3.7 %).

Dysfunction of the autonomic nervous system was taped by means of a series of indicators. According to the data obtained according to the questionnaire for identification of signs of vegetative changes, in the studied group of patients results fluctuated in the range from 7 to 48 points that indicates appreciable scope of estimates, besides, they had no statistically significant differences. Thus, the questionnaire on identifications of signs of vegetative changes only partially confirmed existence of expression of an autonomic nervous system imbalance. Most likely, difficulties of use of this questionnaire are bound to specificity of the examined contingent of patients and are a reason for search of new methodical approaches to diagnostics of vegetative disorders at the poststroke patients.

For a research of neuromuscular excitability in the studied groups Hvostek's test was used. In a type of the fact that according to G. M. Dyukova (1991) positive symptoms of Hvostek occur at 3–29 % of healthy persons, the test was carried out not only at rest, but also after a minute hyperventilation. Traditional hyperventilation with an acceleration of respiration within 3–4 minutes wasn't carried out because of the tenderness of examined patients. This symptom was positive at 75 (70.8 %) patients, at the same time there was a distinct increasing of degree of expression of a symptom after a hyperventilation that proved existence of signs of the increased neuromuscular excitability in most part of the poststroke patients.

After the treatment all patients underwent similar tests. According to complaints, subjectively 32 (30.2 %) persons noted appreciable improvement of a state, 44 (41.5 %) persons – improvement, 21 (19.8 %) persons – minor improvement, 9 (8.5 %) people – lack of any changes.

Change of indicators of a psychoemotional condition of patients before treatment is shown by Table 2.

*Table 2*
**Indicators of a psychoemotional condition of patients in the early recovery period of an ischemic stroke**

| Indicators | Patients | |
|---|---|---|
| | Before treatment | After treatment |
| Reactive uneasiness | 48.3±0.81 | 41.4±0.77 |
| Personal uneasiness | 44.1±0.53 | 40.1±0.49 |
| Beck's test | 22.7±1.21 | 18.9±0.9 |

Considerable changes were demonstrated in uneasiness of patients. Statistically significant decrease in indicators to 41.4 points approaches the moderate level of uneasiness, which is the basic, protective mechanism of social reaction.

Much more stable were indicators of personal uneasiness, which are one of characteristics of an individual and are less subject to influences of the external environment.

A certain progress can be noted also in correction of depressive manifestations at this group of patients. Decrease in number of points to 18,9 is statistically reliable and positively characterizes results of the treatment. Certainly, the reason of decrease in this indicator without specific antidepressive therapy is result of improvements of neuromediator processes in a brain of the patient, decrease in uneasiness and increase in the general physical activity against the background of treatment by Mexidol. At the same time depression level still remains high and demands additional pharmacological correction.

**Conclusions.** Dysfunctions of the autonomic nervous system at the patients who had an ischemic stroke are presented by a wide range of complaints and meet in most part of patients. Moreover, the high prevalence of clinically significant depressive manifestations among the patients with speech disorders was found. Because of detected difficulty of contact establishment with such patients, the need to develop new tools for clinical diagnostics for assessment of cognitive and depressive status is needed, along with improvement of therapeutic abilities and possibility of a contact with a patient during rehabilitation activities. Among the patients in a group without speech disorders and in a group of patients with dysarthria, there was found a strong correlation between mobility deficiency and depressive disorders. It indicates the necessity of development and implementation of new methods and technologies for adaptation and rehabilitation of this group of patients. It is also necessary to note, that the patients who had an ischemic stroke, as usual, possess the appreciable list of premorbid somatic pathology which limits therapeutic opportunities of pharmacological treatment with antidepressants and anxiolytics. The multimodal action of Mexidol allows to reach necessary antioxidant effect in combination with a possibility of simultaneous correction of psychoemotional changes at patients in the early recovery period of an ischemic stroke.

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# IMPORTANCE OF EEG FEATURES IN ACTIVE AND QUIET SLEEP FOR ASSESSMENT OF NEWBORN BRAIN MATURATION AT NEONATAL CENTRES

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# АНАЛИЗ ЗНАЧИМОСТИ ЭЭГ В БЫСТРОЙ И МЕДЛЕННОЙ ФАЗАХ СНА ДЛЯ ОЦЕНКИ РАЗВИТИЯ МОЗГА НОВОРОЖДЕННЫХ В НЕОНАТАЛЬНЫХ ЦЕНТРАХ

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Newborn brain development can be analysed and interpreted by EEG-experts scoring maturity-related features in sleep electroencephalogram (EEG). These features widely vary during the sleep hours, and their importance can be different in quiet and active sleep stages. The level of muscle and electrode artefacts during the active sleep stage is higher than that in the quiet stage that could reduce the importance of features extracted from the active stage. In this paper, we use Bayesian methodology of averaging over Decision Tree (DT) models to assess the newborn brain maturity and explore importance of EEG features extracted from the quiet and active sleep stages. The use of DT models enables to find the EEG features which are most important for the brain maturity assessment. The method has been verified on EEG data recorded from 995 patients of neonatal centres under a project of the University of Jena (Germany) in 2004. The research has been supported by the Leverhulme Trust (UK), and anonymised EEG recordings have been made available for public research under support of the University of Bedfordshire (UK).

*Keywords: newborn electroencephalogram, feature importance, sleep stages, Bayesian classification, decision trees*

Для решения задач оценки развития мозга новорожденных эксперты неонатальных центров в Европе и Северной Америке используют электроэнцефалограммы (ЭЭГ), записанные во время сна новорожденных, для последующего распознавания и анализа прогностических признаков. Эти признаки, однако, варьируют в течение сна, в то время как их параметры различаются в медленной и быстрой стадиях сна. Уровни мускульных