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MORPHOLOGICAL CHANGES OF THE CENTRAL NERVOUS SYSTEM IN ACUTE AND CHRONIC ALCOHOLISM

(Review article)

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✓ ***Resume***

The articles, materials of scientific conferences, as well as other information sources of the collection of reliable information about the anatomical structure of the human brain and animal morphometry, animals, as well as the changes occurring in acute and chronic alcoholism were studied.

It has been proven that in acute and chronic alcoholism, alcohol affects all the morphometric structures of the brain and leads to their irreversible changes in particular the microshogs of the brain.

Keywords: alcohol, brain edema, swelling, cerebral cortex, age-related changes.

МОРФОЛОГИЧЕСКИЕ ИЗМЕНЕНИЯ ЦЕНТРАЛЬНОЙ НЕРВНОЙ СИСТЕМЫ ПРИ ОСТРОМ И ХРОНИЧЕСКОМ АЛКОГОЛИЗМЕ.

(Обзорная статья)

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✓ ***Резюме***

В обзорной статье представлен анализ современных научных данных российских и зарубежных исследований об изменениях головного мозга при остром и хроническом алкоголизме. Алкоголь затрагивает вес организм человека, однако основной мишенью для него оказывается головной мозг, что определяется его тонкой структурой и легко повреждаемыми механизмами защиты.

В то же время, как показывает, анализ литературы при воздействии этилового спирта происходят дегенеративные изменения всех структур головного мозга.

Ключевые слова: алкоголь, отек мозга, набухание, кора головного мозга, возрастные изменения

ЎТКИР ВА СУРУНКАЛИ АЛКОГОЛИЗМДА МАРКАЗИЙ АСАБ ТИЗИМИНИНГ МОРФОЛОГИК ЎЗГАРИШЛАРИ

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✓ ***Резюме***

Журналлар, илмий анжуман материаллари, шунингдек бошқа манбаларда ўткир ва сурункали алкоголизм таъсирида бош мияда келиб чиқадиган ўзгаришлар таҳлил қилинган. Алкогол инсон организмининг барча қисмларига, бироқ асосий нишон аъзоси бу бош мияга кўпроқ таъсир этиши ва бу ҳолат миянинг нозик тузилиши ва ҳимоя механизмлари осонгина зарарланиши билан белгиланади.

Калит сўзлар: алкоголь, бош мия шиши, бўкиш, бош мия пўстлоғи, ёшга оид ўзгаришлар.

Relevance

The human brain is a more complex and highly organized organ that coordinates and regulates all vital functions of the body. Despite a sufficiently large number of publications and studies on the anatomy of the brain, most of them concern postnatal ontogenesis and, mainly, people of mature and elderly age. A large number of publications address the issues of anatomy of brain departments and structures, its blood supply, the structure of the cortex, glial elements, morphology of basal nuclei, age-related changes in the anatomy of the brain.

The brains of animals and humans are symmetrical in the presence of structures, the morphology and size of which have interhemispheric differences. To solve complex problems, the brain acquired the property of functional asymmetry [21].Structural and functional hemispheric asymmetry was revealed in humans [1,2] and animals [3].

The question whether morphological differences of the cerebral cortex, which can even serve as their material basis, are reflected in functional manifestations, remains extremely relevant [23]. V. L. Bianchi believes that functional asymmetry does not necessarily have to be accompanied by morphological [3], whereas E.Yu. Krysova argues that the structural differences of the hemispheres are the basis of functional [12]

It is known that alcohol consumption is a social problem all over the world. The country's authorities regularly organize campaigns to reduce alcohol consumption and improve public health. Nevertheless, the problem remains relevant and the data for the region show interesting figures and trends. According to a WHO report in 2016, harmful alcohol consumption led to approximately three million deaths (5.3% of all deaths) worldwide. Mortality from alcohol consumption is higher than from diseases such as tuberculosis, HIV/AIDS and diabetes. Also, according to WHO estimates, 2.3 million deaths among men in 2016 were associated with alcohol consumption. Women, in turn, have experienced 0.7 million alcohol-related deaths.

The abuse of alcoholic beverages is one of the most important problems facing modern society and medical science [7,16,17,22]. Ethanol and its metabolites, being powerful tissue poisons, affect various organs [10,15,17,19,32,33,39], but primarily on the brain.

In recent years, mortality from chronic alcoholism and acute alcohol intoxication, as well as concomitant complications, occupies a leading position, second only to mortality from cardiovascular pathologies and malignant neoplasms[27]. Affecting not only the physical, but also the mental sphere of life, alcohol has been, is and is becoming an increasingly serious problem, threatening dangerous consequences not only for an individual, but also for the entire population as a whole.

Although significant progress has been made in obtaining new knowledge about the mechanisms and pathology of alcohol intoxication, many links of pathogenesis and its effect on the course of certain diseases remain unknown and require further study. Ideally, on animal models that mimic this condition in humans. Rodents are the most convenient model for a number of well-known reasons. Differences in the degree and stages of alcohol damage to the body exist in rats, mice and humans, data collection and their translational significance remain in demand [20]

One of the first places among structures that are particularly sensitive to the toxic effects of ethanol is occupied by the Central nervous system [8]. Moreover, the spectrum of ethanol's influence on this system is quite wide: in small doses, alcohol exhibits a depressant effect; when consuming large doses of ethanol, a more widespread oppression of a significant number of different structures of the central nervous system develops, leading to disorganization and disruption of highly integrated processes [25].

It should be noted that the most important role in the formation of signs of alcohol intoxication is occupied by a violation of the functional state of brain neurotransmitters under the influence of ethanol [37,40].

At the same time, among the target organs, the brain is one of the main ones. According to the literature, the overwhelming number of works devoted to the study of pathomorphological changes in the brain during poisoning concerns cases of death from acute alcohol intoxication. In the brain, there is a swelling of astrocyte bodies, in all layers of the cortex there is a significant number of acutely lysing neurons, shadow cells, most of which are phaged by glia, the number of shrunken cells increases, distinct changes of neurons are traced in the basal nuclei of the hemispheres and nuclei of the brain stem; microcirculation disorders with pronounced fullness of the capillary and venous parts of the microcirculatory bed are noted and the formation of multiple multiple diapedetic hemorrhages. The walls of capillaries and venules are swollen, perivascular spaces are expanded, filled with protein fluid; the lumen of small-caliber arteries and precapillaries are expanded, their wall is thinned; vessels

of the substance of the brain with the phenomena of sharp dystonia, their pronounced tortuosity is noted, "corrugation", edematous loosening of the walls, perivascular edema are revealed on the cross sections; there is widespread fibrosis of capillaries and arterioles, many small arteries are hyalinized, in larger ones there is a significant thickening of adventitia, areas of capillary desolation are revealed in the cerebral cortex and cerebellum [5,36].

In acute alcohol poisoning, edema of all parts of the brain comes to the fore. In the vascular plexuses of the brain, swelling and swelling of the intercellular substance, basal membranes and stroma of the villi are also observed, which leads to compression and desolation of capillaries, necrosis and desquamation of the epithelium, etc. [5,11].

In the structures of the brain of rats with acute ethanol intoxication, signs of perivasal edema are determined, often areas of hemorrhages of diapedetic genesis, which can be both local and widespread. In some cases, hemorrhagic foci affect, in addition to white and gray matter, subcortical and stem parts of the brain [34].

To date, the study of the effect of alcohol intoxication on the rat body continues, in modern works the following topics are touched upon: the effect of ethanol on the optic nerve [31]; the intrauterine effect of alcohol on the reactivity of cerebral arterioles of the brain and its susceptibility to ischemic damage in adulthood [30]; changes in the level of circulating insulin and ghrelin in chronic alcohol intoxication [38];

With chronic alcohol intoxication, and poisoning with alcohol surrogates in combination with chronic alcohol intoxication are the result of alcoholic illness, therefore there are common signs characterizing both of these conditions. Thus, histologically, in the structures of the brain, fullness, perivascular and pericellular edema, increased vascular permeability are detected, severe forms of neuron pathology are noted: dark cells, "shadow cells", lysis of the nucleus and nucleolus. Alcohol surrogates are liquids used for the purpose of intoxication instead of alcoholic beverages. Surrogates of alcoholic beverages are a mixture of alcohol and water with the addition of impurities for taste and smell, which have a certain effect on the course of poisoning with ethyl alcohol. Thus, significant amounts of these impurities are found in alcoholic beverages prepared in an artisanal way (moonshine); adulterated beverages (tincture of diluted moonshine on "intoxicating" substances); pharmacy tinctures not intended for ingestion, etc. [24].

In the brain, with chronic ethanol intoxication, dystrophic and atrophic changes in brain neurons develop, as well as sclerosis and hyalinosis of its vessels. Petrifications and cysts appear on the site of necrosis foci, areas of demyelination are formed, diffuse microgliosis of tissue develops. In addition, quantitative relationships between the structural components of the brain are disrupted: the specific area of neurons decreases due to their progressive atrophy and death, while at the same time the indicators characterizing the development of the glial component increase. Planimetry showed that the specific area of neurons in the cortex of the anterior central gyrus of the hemispheres, the medial nucleus of the visual tubercle and the medulla oblongata decreased by 1.2 times. The area occupied by glial cells, on the contrary, increased 1.3 times in the cortex, 1.2 times in the visual mound, and 1.4 times in the medulla oblongata, which indicates a change in the ratio between nerve cells and the stroma of the brain in favor of the latter [26].

When opening the brain of alcoholics, subdural hematomas are often found – the consequences of injuries; fibrosis of the soft meninges; signs of intracranial hypertension, as evidenced by pronounced pachyonic granulations – graduates of the liquor from its internal reservoirs. There is also atrophy of the cortex and subcortical white matter of the brain, neuronal devastation in the brain [29].

Alcohol can cause damage to most organs, it contributes to the development of more than 60 different diseases, makes a significant contribution to the morbidity and mortality of the population [8]. Along with this, the intake of ethanol into the body is accompanied by significant violations of all types of metabolism, the functioning of neurotransmitter systems, the occurrence of endocrine disorders [37].

According to Mammadgasanov, T.S. alcohol intoxication has a negative effect on brain tissue, expressed by degeneration of neurons. Despite this, ultrastructural changes occurred in the cytoplasm of these neurons, which indicate the activation of the nuclear apparatus, hypertrophy of the nucleolar apparatus, condensation of ribosome subunits near its nuclear membrane, an increase in the area of the karyolemma due to the folding of the membrane. Adaptive changes of these neurons were also manifested, reflected due to the detection of signs of destruction and hypertrophy of various organelles (endoplasmic network, Golgi complex, lysosomes, mitochondria. It should be noted that the most important role in the formation of signs of alcohol intoxication is occupied by violations of the

functional state of brain neurotransmitters under the influence of ethanol [14]. It is proved that ethyl alcohol is membranotoxic and as a result of its systematic use, the gray and white matter of the brain is damaged, which is accompanied by the loss of myelinated fibers and neurons, the gradual development of brain atrophy, degradation of the microstructures of the corpus callosum, a decrease in neuronal and glial markers, which creates the basis for neuropsychological disorders [9].

After absorption into the blood, ethanol first of all has a disinhibiting effect on the central nervous system and disrupts the interaction of subcortical nuclei with cells of the cerebral cortex, with continued exposure to alcohol, a phase of depression follows, dictated by gross organic changes in the brain, in severe cases leading to death [13,19].

The study of the histological structure of the brain of people with chronic ethanol intoxication revealed signs of sclerosis and hyalinosis of its vascular bed. At the same time, it was found that they concern not only arteries and arterioles, but also capillaries, i.e. the chronic process with atrophy of the smooth muscles of the media and wall compaction extends to the vessels of all levels of branching of the blood flow to the brain. At the same time, it is important to note the presence of infiltrates from mononuclear cells in the adventitia of arteries and veins, as well as along the course of capillaries. Perhaps this is due to the reaction of the immune system to damage to the vascular walls and their infiltration by plasma proteins during repeated repeated exposure to alcohol [26].

Hyalinosis and sclerosis of the intramural arteries are found in the vessels of the base of the brain, which indicates the toxic effect of ethanol on the vessels. There is a lesion of the 3rd and 5th layers of the brain tissue of the frontal lobes, as well as the molecular and ganglion layers of the cerebellar cortex in the form of an increase in the number of hyperchromic, reduced in volume neurons and a decrease in the number of normochromic cells [28,35].

During operations with the removal of subdural hematoma, there is a fullness of small cerebral vessels, dilation of venules, arteries, a sharp fullness of the brain and meninges. Patients have a violation of the permeability of vascular walls, perivascular edema, hemorrhages of various characteristics not only within the central nervous system, but also in internal organs. Chronic vascular disorders are detected in the form of cerebral vascular fibrosis, aneurysmal protrusions [6].

Conclusion

Thus, our analysis of data from domestic and foreign literature shows that there are indeed many works on the study of acute and chronic effects of alcohol on the central nervous system. There are no works on the study of the complex morphofunctional state of the brain in alcohol intoxication and the methods of their correction are insufficiently illuminated and contradictory. This determines the need for further research and to do this, it is advisable to use a set of pathomorphological, morphometric, histochemical research methods.

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