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MORPHOLOGICAL CHANGES IN BRAIN STRUCTURES IN ALCOHOLISM (LITERATURE REVIEW)

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Annotation: The analysis of modern scientific sources on the problem of studying structural changes in the brain during intoxication and alcohol poisoning is carried out. It is emphasized that in all structures of the central nervous system, changes are observed up to atrophy of the cortex and subcortical structures of the brain. There are disorders of microcirculation in the vessels of the brain with the formation of multiple diffuse diapedous hemorrhages.

Keywords: brain, neuron, sclerosis and hyalinosis of the vascular bed, brain atrophy

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 relate to postnatal ontogenesis and, mainly, people of mature and elderly age. A large number of publications address the issues of anatomy of departments and structures of the brain, its blood supply, the structure of the cortex, glial elements, morphology of the basal nuclei, age-related changes in the anatomy of the brain.

The abuse of alcoholic beverages is one of the most important problems facing modern society and medical science [17]. Ethanol and its metabolites, being powerful tissue poisons, affect various organs [15,33,35], but primarily the brain[7,12,16,34].

In recent years, mortality from chronic alcoholism and acute alcohol intoxication, as well as concomitant complications, has occupied a leading position, second only to mortality from cardiovascular pathologies and malignant neoplasms[18,19]. 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 gaining 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 [14].

One of the first places among structures that are particularly sensitive to the toxic effects of ethanol is occupied by the central nervous system [4]. 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 [17].

The effect of ethanol on the brain is due to its independent effect on nervous tissue, as well as the effect of alcohol metabolites (acetaldehyde, acetate, adenosine, salsolinol, etc.) [1, 5].

Under the influence of prolonged alcohol exposure, neurons in the central nervous system are eventually damaged and neurodegenerative changes develop [24]

Alcohol can cause a wide range of effects on the central nervous system. Computed tomography studies have reported changes in the frontal lobe in alcoholism, and magnetic resonance imaging studies have confirmed these results. Neurophysiological studies using positron emission tomography and single-photon emission computed tomography have shown a decrease in glucose utilization in the frontal lobes and a decrease in cerebral blood flow leading to dysfunction of the frontal lobes. Since the frontal lobe is not an isolated part of the brain, taking into account its close connections with various cortical and subcortical regions of the brain[25].

In order to provide a visualization basis in patients with alcohol dependence, MRI can detect even mild brain atrophy where areas of brain atrophy predominate[28].

In an animal experiment, a morphometric assessment of the effect of traumatic shock on the brain against the background of acute alcohol poisoning was carried out. Chronic alcohol intoxication is manifested by significant focal damage to neurons, a decrease in the number and sclerosis of the walls of arterioles. However, the most affected structures were the hypothalamus and cerebellum. Morphometrically, significant destruction of neurons in acute alcohol intoxication has been shown[23].

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[30,36].

Signs of perivasal edema are detected in the structures of the rat brain during acute ethanol intoxication, 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 regions of the brain [27].

To date, the study of the effect of alcohol intoxication on the rat body continues, modern works address the following topics: the effect of ethanol on the optic nerve

[26]; the intrauterine effect of alcohol on the reactivity of cerebral arterioles of the brain and its susceptibility to ischemic damage in adulthood [23]; changes in the level of circulating insulin and ghrelin in chronic alcohol intoxication [32].

In the brain, with chronic ethanol intoxication, dystrophic and atrophic changes in the neurons of the brain 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 the tissue develops. In addition, the 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 optic tubercle and the medulla oblongata decreased by 1.2 times. On the contrary, the area occupied by glial cells increased 1.3 times in the cortex, 1.2 times in the optic tubercle, 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 [18].

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 cerebrospinal fluid from its internal reservoirs. There is also atrophy of the cerebral cortex and subcortical white matter, and neuronal devastation in the brain [21].

Alcohol can damage most organs, it contributes to the development of more than 60 different diseases, and makes a significant contribution to the morbidity and mortality of the population [4]. Along with this, the intake of ethanol into the body is accompanied by significant disorders of all types of metabolism, functioning of neurotransmitter systems, and the occurrence of endocrine disorders[30].

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 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 membrane folding. Adaptive changes in these neurons were also manifested, reflected due to the detection of signs of destruction and hypertrophy of various organelles (endoplasmic reticulum, Golgi complex, lysosomes, mitochondria. It should be noted that the most important role in the formation of signs of alcohol intoxication is occupied by disorders of the functional state of brain neurotransmitters under the influence of ethanol.

It has been proven 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 [6].

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 [9,12].

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 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 [18].

With alcohol intoxication, pronounced swelling of the brain and the soft meninges with accumulation of a large amount of fluid under it is often observed. Swelling and dystrophic changes of astrocytes, which are part of the blood-brain barrier, occur in it. Astrocytes transfer the bulk of ethanol into cerebrospinal fluid[8].

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[20,29].

During operations to remove a subdural hematoma, there is a fullness of small cerebral vessels, dilation of venules, arteries, and 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 [3].

Thus, our analysis of data from domestic and foreign literature shows that alcohol sickness is a disease in which prolonged repeated ethanol intoxication leads to morphological changes in all organs and systems of the body, but to a large extent

affects the central nervous system. This begins with minimal changes in vascular lesions of the microcirculatory bed of the brain until the death of its structures.

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