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MORPHOFUNCTIONAL ACTIVITY OF NEUROSECRETER CELLS IN THE ARCUATIC NUCLEUS OF HYPOTHLAMUS DURING THE PERIOD POST-REANIMATION DISEASE

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Annotation

In the postresuscitation period through the I-II-III-IV-V-stages and long-term periods (1 and 3 months) of postresuscitation illness, when modeling a 10-minute clinical death, we studied the relationship between the reactivity of the autonomic nervous system and the morphofunctional activity of neurosecretory cells of the arcuate nucleus of the hypothalamus of white mature rats - males, weighing 180-220 grams, who underwent a 10-minute arrest of systemic circulation (clamping of the vascular bundle of the heart according to the method of V.G. Korpachev). Sham-operated animals served as control. Physiological, morphological, morphometric, histochemical, cytophotometric studies of the state of reactivity of the autonomic nervous system and morphofunctional activity of neurosecretory cells of the arcuate nucleus of the hypothalamus were carried out. We used image analysis using a Leiss microscope with an electronic micro-attachment connected to an Intel computer, and the content of neurosecretory substances was studied using a cytophotometer. In the postresuscitation period, during stage I, hyperhydration of the cytoplasm of neurosecretory cells of the arcuate nucleus of the hypothalamus was revealed against the background of the predominance of the tone of the parasympathetic nervous system. During stage II of the predominance of the tone of the parasympathetic nervous system, starting from stage III of the disease, against the background of the predominance of the tone of the sympathetic nervous system, hyperhydration of the nuclei of neurosecretory cells of the arcuate nucleus of the hypothalamus is observed with an increase in the release of neurosecret into the blood, i.e., compensatory-adaptive reactions were observed. Compensatory-restorative processes with a

shift towards depletion of neurosecretory cells of the arcuate nucleus were observed starting from stage IV and in the remote periods of postresuscitation disease against the background of the predominance of the tone of the sympathetic nervous system and overhydration of the nuclei.

Key words: Clinical death, postresuscitation disease, period, arcuate nucleus, neurosecretory, sympathetic nervous system, parasympathetic nervous system.

Relevance. The study of the mechanisms and patterns of disorders developing at the level of the hypothalamic-pituitary system is essential for identifying the mechanism of violation of the body's reactivity in the postresuscitation period. Hypoxic and reoxygenation processes undoubtedly reflect on the morphofunctional states of the cells of the central nervous system (CNS), the autonomic nervous system [10], respectively, and the neurosecretory structures of the hypothalamic-pituitary system of the body [17,23,25,2,4,22].

Currently, one of the most urgent tasks of resuscitation is the search for effective methods of protecting the nerve cells of the brain and subcortical structures, as well as the reactivity of the peripheral endocrine glands of the patient's body [1,8].

In the postresuscitation period, the predominance of the activity of the sympathoadrenal system and the activation of the ergotropic function of the body contributes to the predominance of catabolic processes with the formation of ATP in the cellular structure [6,14,24]. At the same time, the reproductive state of the body's cells remains at a disadvantage, that is, an imbalance occurs between the sympathetic and parasympathetic nervous systems, between the catabolic and anabolic hormonal systems and processes [13,2,19,18,21].

The main link responsible for the reproductive state of the body is the preoptic and arcuate nuclei of the hypothalamus, as well as the alpha and beta-basophilic cells of the adenohypophysis, which lead to an increase in gonadal hormones and the subsequent development of physiological reactions of the body [11,17, 20, 7, 24, 25] ...

To analyze the patterns and mechanisms of postresuscitation changes in the cyclic center of the reproductive system, it seems essential to study the relationship between the reactivity of the autonomic nervous system and the morphofunctional activity of neurosecretory cells in the arcuate nucleus of the hypothalamus in the postresuscitation period when simulating a 10-minute clinical death.

Purpose of the study. To reveal the relationship between the reactivity of the autonomic nervous system and morphofunctional changes in the neurosecretory cells of the nuclei of the arcuate nucleus of the hypothalamus in stages I-II-III-IV-V and long-term periods (1 and 3 months) of post-resuscitation disease when simulating a 10-minute clinical death.

Materials and research methods. In connection with the task, the study was carried out on 70 outbred male rats weighing 170-220 grams, in which the state of clinical death and postresuscitation disease was simulated [10]. All studied animals were divided into 2 groups.

Group I included 35 intact rats (sham-operated animals)

In group II, 35 rats, postresuscitation sickness was modeled after 10 minutes of clinical death. At the same time, the studied rats were in the same conditions and on the same diet.

The slaughter of animals was carried out by simultaneous decapitation. For each term, 10 pieces were hammered. and more animals.

Pieces of the brain, including the hypothalamus with the pituitary gland, were fixed in Bouin's fluid. After passing through alcohols of ascending concentration, the pieces were embedded in

paraffin, then sections with a thickness of 5-7 μm were prepared from them, oriented in the frontal or sagittal planes.

Sections were stained according to the following methods:

1) Paraldehyde staining with fuchsin according to Gomori-Gab with azan stain according to Heidenhain.

2) Staining with chromium-alum hematoxylin and floxin according to Gomori.

3) Hematoxylin-eosin for a general overview of sections and judgment on morphological shifts in the cells of the hypothalamic-pituitary system.

The study of the hypothalamus was carried out at the level of the arcuate nuclei of the hypothalamus. The functional activity of the neurosecretory cells of the nuclei of the arcuate nuclei of the hypothalamus was determined by the criteria of the functional activity of cells (high, moderate and low activity) by the content of neurosecretory, measuring the volume of the nuclei and cytoplasm of neurosecretory cells, which includes calculating the percentage of certain types of neurosecretory cells [12].

The content of the neurosecret was determined by a two-wave cytophotometric method.

The volume of the cytoplasm, nuclei and nucleoli of cells was measured using an MOV-1-15 micrometer.

The functional nature of the nuclei was assessed using the nuclear-cytoplasmic ratio index. Index = About nucleus / volume of cytoplasm. An increase in the index indicates an increase in genetic activity and hydration of cell nuclei. A decrease in the index indicates the hydration of the cytoplasm and a decrease in the genetic activity of cell nuclei [18].

The reactivity of the autonomic nervous system was determined using the Hildebrant coefficient [3].

To determine the reliability of differences between the indicators of individual groups of experimental animals, statistical processing was performed using the standard Microsoft Office - Excel 2000 software package. Differences between the two compared indicators were considered reliable at $P = 0.05$ and $P < 0.05$.

Research results and their discussion. In the study of intact animals against the background of mixed ANS reactivity, NSC ARN are in the stage of moderate functional activity, while NSCs of moderate functional activity - 68.0 ± 0.5%, and NSCs of high and low functional activity - 11.8 ± 0.7% and 15.0 ± 0.5%. Between these cells, NSCs of a destructive nature are found up to 5.2 ± 0.4% (hyperchromoepycnotic cells). Their nuclei are hyperchromic, chromatin in them is diffusely located throughout the nucleus, the nucleolus is located mainly in the center of the nucleus. The nuclear-cytoplasmic index is 0.227 ± 0.0006. The nuclei of glial satellite cells are also chromatic, the area varies within 14.2 ± 0.3 a.u. The capillary network is slightly hyperemic, the diameter of the capillaries is 5.8 ± 0.05 μm.

After the onset of clinical death against the background of vagotonia after 10 minutes, the NSC ARYa are slightly swollen, there are some decreases in the intensity of the NSC in the cytoplasm of cells. The nucleus is chromatic, chromatin in them, as in intact animals, is diffusely located throughout the nucleus. There is a decrease in the number of NSCs of low functional activity, respectively, with an increase in the number of NSCs of high functional activity, but the indicators are insignificant ($P > 0.05$).

In the early postresuscitation period (stages I-II of post-resuscitation disease) against the background of the reactivity of the ANS, the tone of the parasympathetic nervous system

(PSNS), there is a further increase in the NSC of high functional activity - 37 , 4 ± 0.8% (P <0.001) with a decrease in the number of NSCs of moderate and low functional activity to 49.4 ± 1.4% and 6.8 ± 0.6% (P <0.001) , while the index of the nuclear-cytoplasmic ratio is reduced to 0.223 ± 0.0005 (P <0.01). Coming to the II-stage of postresuscitation disease, there is an increase in the number of destructively altered NSCs in the form of cytolysis to 6.4 ± 1.9%, but the indicators are insignificant (P> 0.05). The vascular network in the area of the ARF is hyperemic, marked perivascular edema is noted, the diameter of the capillaries is increased to 6.4 ± 0.1 microns (P <0.05).

Coming to stage III of postresuscitation disease against the background of the prevalence of SNS tone in the ANS reactivity, the severity of hyperemic capillary network against the background of perivascular edema, as well as an increase in the functional activity of glial satellite cells in the form of vacuolization of the cytoplasm and with an increase in the area of nuclei with two nucleoli to 18.0 ± 0.2 u.u. (P <0.001), there is a sharp increase in the number of NSCs of high functional activity by hypertrophied nuclei with eccentrically located nucleoli up to 66.0 ± 1.3% (P <0.001), with a decrease in the number of NSCs of moderate and low functional activity up to 20.4 ± 1.3% (P <0.001) and 5.4 ± 0.2% (P <0.001), there is an increase in the nuclear-cytoplasmic ratio index to 0.229 ± 0.004 (P <0.05). At the same time, there is a lag in the synthesis of NSVs from its secretion and a further increase in the number of destructively altered NSA in the form of karyolysis and cytolysis to 8.0 ± 0.4% (P <0.01) with a shift towards depletion.

Recovery processes, starting from stage IV, during stage V and long-term periods (1-3 months) of postresuscitation disease against the background of the predominance of SNS reactivity, hyperemic capillary network with manifestation of perivascular edema and a further increase in the area of the nuclei of glial satellite cells to 18, 5 ± 0.2 u.u. (P <0.001), when the vicar compensation of NSC with two nucleoli is connected, as well as with an increase in the number of destructively changed NSC to 8.2 ± 0.4% (P <0.001), an increase in the number of NSC is noted from moderate functional activity to 36.8 ± 0.5% (P <0.001) with an increase in chromatin in the nucleus, that is, there is a restoration of the morphofunctional activity of the NSC ARN of the hypothalamus.

As the duration of the period of postresuscitation disease lengthens, these processes are significantly delayed. That is, against the background of the reactivity of the SNS, there is an increase in the number of destructively altered NSCs of a hyperchromic-pycnotic nature.

Therefore, if we interpret the data obtained, in the early postresuscitation period (I-II stages of the disease) against the background of the predominance of the PSNS tone, hyperemia of the capillary network with pronounced perivascular edema, and a decrease in the nuclear-cytoplasmic ratio index, we can speak of hyperhydration of cytoplasm. ¬plasmas during the passive phase of the functional activity of the nuclei of the NSC ARN [18].

As for the increase in the ARN NSC of high functional activity and the index of nuclear-cytoplasmic ratio, an increase in the number of two nucleolar cells - in the later stages of resuscitation, which we found in the III-IV-V - stages and long-term periods of postresuscitation disease against the background of the predominance of reactivity, and chromatin, this can be interpreted as one of the additional mechanisms of compensatory processes, since the latter is an indicator of the activation of the genetic apparatus in them [18, 16, 11]. If these data are interpreted with the data of Zavodovsky, then the development of postresuscitation disease is

based on the lack of peptide neurohormones NSC ARN, which are responsible for the productive state of the organism.

Thus, based on the data obtained, the following can be done.

Conclusions:

1. After the onset of clinical death against the background of vagotonia, after 10 minutes, there is a slight increase in the morphofunctional activity of the NSC ARYA.
2. In the early I-II stages of postresuscitation disease, against the background of the prevalence of PSNS reactivity and an increase in destructively altered NSCs in the form of karyolysis, plasmolysis, there is an increase in the morphofunctional activity of the NSC ARN.
3. In the III-stage of postresuscitation disease, against the background of the predominance of the SNS tone and the activation of the trophic function of glial satellite cells in the form of vacuolization of the cytoplasm and an increase in the area of the nuclei, the morphofunctional activity of the NSC ARN is at the stage of maximum functional activity when the synthesis of NSV lags behind its secretion with a shift in side of exhaustion.
4. Starting from stage IV, as well as stage V and in the remote periods of postresuscitation disease against the background of the predominance of SNS tone, an increase in the area of glial satellite cells with two nucleoli, vicar compensation of NSC and an increase in the number of destructively altered NSC, a recovery process is noted, according to as the duration of postresuscitation disease lengthens, the recovery process is aggravated with a shift towards exhaustion.

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