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Violation in the Post Resuscitation Disease Period: Recent Evidance

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Abstract **Background:** Post resuscitation ischemic damage is considered one of the most unfavorable pathogenic factor that elicits irreversible changes to the organs and tissues. The mechanism of a reperfusion damages are complex and cause metabolic violations that promote development of endogenic intoxication, intracellular edema and other alterations. As a result of which necrosis and apoptosis of cells are developed. **Objective:** Determining mechanism of violation in Hypothalamic Pituitary system in post resuscitation period in simulation during 10 minute of clinical death. **Study Materials:** In connection with given task, study is conducted to 70 no-breed male rats with a 130-220 gram of body mass in which simulations were done clinical death states. All the studying rats were divided to two groups: in the 1st group were included 35 intact rats; in the 2nd group were included 35 rats. **Results:** At I stage of post resuscitation period, prevalence in reactiveness autonomic nerve system the tone of parasympathetic nerve system (PSNS) is P<0,0001, increase in products is 120,7% and some decrease in antioxidant systems such as catalases down to 89,3% and peroxidases down to 93,6%. **Conclusion:** There is a vicarial compensation of PSNS with low level containing in the neuro-secretory substance and low level of glycoproteids in b- and d-basophilic adenocytes. Accordingly, noted increase in the amount of destructively changed NSC, PON, ARN with the shift toward the exhaustion.

Keywords Hypothalamic-pituitary system, Intracellular edema, Metabolic violations

1. Background

Post resuscitation ischemic damage is considered one of the most unfavorable pathogenic factor that elicits irreversible changes to the organs and tissues [4]. The mechanism of a reperfusion damages are complex and cause metabolic violations that promote development of endogenic intoxication, intracellular edema and other alterations. As a result of the above stated develops necrosis and apoptosis [1-3]. Herewith, firstly damaged cells of the Central Nerve System and Neuroendocrine system particularly, cortical and subcortical structures [5,6]. Damage on subcortical structures specifically to a mesolimbic structures and to the cells of hypothalamic nuclei will promote violation in adaptive capabilities of the body to injuries. Mechanism of development for post resuscitation damages of cellular structures have not been studied fully till present time and remains as an actual problem for resuscitative care.

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2. Objective

Determining mechanism of violation in Hypothalamic Pituitary system in post resuscitation period in simulation during 10 minute of clinical death.

3. Tasks of the Study

Study reactiveness of Autonomic Nerve System (ANS), neuro-secretory cells (NSC), periotic nucleus (PON) and arcuate nucleus (ARN) of hypothalamus in median eminence (ME) and B- and D- basophilic cells of adenohypophysis as well as, endogenic intoxication index in post resuscitation period in simulation during 10 minute of clinical death.

4. Study Materials

We study is conducted to 70 no-breed male rats with a 130-220 gram of body mass in which simulations were done clinical death states. All the studying rats were divided to two groups: in the 1st group were included 35 intact rats; in the 2nd group were included 35 rats to which simulations were done during 10 minute clinical death state and studied

morpho-functional state of hypothalamic- pituitary system, reactiveness of ANS, antioxidant system of Malonic Dealdehyde (MDA), catalases, peroxidases, and state of the product for peroxide oxidation of lipids (POL) during I, II, III, IV, V stages and remote period (1-3 month) of post resuscitation disease. Slaughtering of animals were conducted by immediate decapitation.

5. Methods of the Study

In studying reactiveness of the Autonomic nerve system Hildebrand coefficient is used. Reactiveness for PON, ARN, ME, b- and d- basophilic cells of adenohypophysis are studied with the help of morphologic and histo-chemical methods. Besides listed indexes, we had also taken into consideration general state of the animals in a process of dying and in post resuscitation period. The condition of the heart functioning was observed with the use of cardio-monitor "Raketa". Artificial pulmonary ventilation (APV) was provided with APV for small laboratory animals.

Statistic processing is made by means of standard package Microsoft Office- Excel 2000. The differences of two compared factors considered to be reliable under P=0,05 and R<0,05.

6. Results and Discussions

At I stage of post resuscitation period, prevalence in reactiveness autonomic nerve system the tone of parasympathetic nerve system (PSNS) is P<0,0001, increase in products of POL and MDA is 120,7% and some decrease in antioxidant systems such as catalases down to 89,3% and peroxidases down to 93,6%. Morpho-functional activity dominates in neurosecretory cells and arcuate nucleus in comparison with NSC and PON, and also in d-basal cells than in b-basal cells of adenohypophisis (P<0,001).

On II stage of post resuscitation disease, the tone for parasympathetic nerve system is preserved to reactiveness to Autonomic nerve system (P<0,001), there were further increases in activities for the products of peroxide oxidation of lipids and MDA up to 108,2%, decrease in activity of antioxidant system, catalases down to 91,4% and peroxidases down to 95,8% (P<0,001).

Revealed increase in neurosecretory cells with manifestation of cariolysis and plasmolysis in PON up to 109,7% and in ARN up to 103,2% (P<0,01) with an increase in NSC with high functional activity in ARN up to 105,6% (P<0,01), and in d- basophilic adenocytes high functional activity up to 96% due to hyper hydration of nuclei (P<0,0001). Decrease in the amount of NSC with a moderate and low functional activity, decrease in concentration of neurosecretory substances(NSS) in NCS of ARN down to 99,5% (P<0,001) and glycoproteids in d-basophilic cells of adenohypophysis down to 89,7% (p<0,0001), insignificant decrease of neurosecretory substance in inner and outer layers of ME.

On III stage of post resuscitation disease, due to prevalence in reactiveness of ANS, the tone for sympathetic nerve system (SNS) (p<0,05), shown increase in product of POL and MDA up to 202,2%, decrease in activity of antioxidant system, catalases down to 52,1%, peroxidases down to 28,4% (P<0,001), NSC in PON and ARN as well as b- and D-basophilic cells are in stage of maximal functional activity due to hyper hydration of nuclei. The main peculiarity for this stage is that there is a rapid retardation in synthesis of NSS and glycoproteids and their secretion. Its characterized by maximal increase of NSC with high functional activity in ARN and in b-basophilic adenocytes than NSC in PON and and-basophilic cells of adenohypophysis. Therein, the amount of actively functioning NSC are increased compared with intact animals; ARN increased up to 559,3% and in b-basophilic adenocytes up to 588,7%. Decreasing the amount of NSC with moderate functional activity in ARN down to 30,0% and cells with low activity down to 36%, concentration of NSS in NSC and ARC accordingly down to 69,3% and in ME down to 63,7% including glycoproteids in b-basophilic cells of adenohypophysis down to 81,9% compared with data of intact animals (P<0,001).

Starting from stage IV of post resuscitation disease, due to prevalence of tone for SNS (p<0,001), decreases in endogenic intoxication index in NSC of PON, ARN and in b-and d- basophilic cells of adenohypophysis regeneration process is observed.

Herewith, in an index for endogenic intoxication for the functional activity of the product of POL and MDA are found to be at high level up to 147,1%, and low level in activity of antioxidant system-catalases down to 74,6% and peroxidases down to 85,1% in comparison with intact animals (P<0,001). In hypothalamic pituitary system reduction process is more apparent in NSC of PON and in d-basophilic cells of adenohypophysis compared to NSC of ARN and b-cells of adenohypophysis. Herewith, the amount of NSC with high functional activity in PON is higher up to 473% and in d-adenocytes the amount of high functional activity cells is high up to 533,3% due to hyper hydration of nuclei. Accordingly, under low level of preserving concentration amount of NSC with moderate functional activity in PON is down to 38,2% and d-basophilic cells of adenohypophisis down to 39,8 and further increase of destructive NSC (P<0,001) compared to data of intact animals.

On the V stage of post resuscitation disease due to prevalence in reactiveness of SNS and ANS (P<0,001) is marked as high level of preserving the POL and MDA in normalizing functional activity of antioxidant system, and further reduction in function of NSC in PON and ARN, as well as in basophilic cells of adenohypophysis. Reduction process is more apparent in PON than in ARN and in d-basophilic cells, compared to b-basophilic cells of adenohypophysis, under increased amount of destructively changed NSC in PON is up to 114,6 and in ARN up to 120,8%. Noted a decrease of NSC of high functional activity

in PON in 120% and ARN in 118,9% as well as and b-basophilic adenocytes in 110,5% and in d-basophilic adenocytes in 108,9%.

After a month of resuscitation, in reactiveness of ANS due to prevalence in tone of a SNS (P<0,005%), endogenic intoxication index for POL and antioxidant system almost matches with the data of intact animals. Takes place further reduction for the morpho-functional state of NSC in PON than of a NSC in ARN as well as in d-basophilic cells compared to b-basophilic cells of adenohypophysis. Decrease in the amount of functionally active NSC of PON is down to 63% and in d-basophilic cells down to 55,4%. Accordingly, marked increase in the amount of moderately functionally active NSC of ARN up to 197,1% and in low functionally active ones up to 111,1% and also increase in the amount of destructively changed NSC up to 148,8%.

On the third month of post resuscitation disease, due to further maintenance in reactiveness of ANS tone SNS (P<0,01) observed insignificant increase in activity of a product of POL, MDA, and in antioxidant system insignificant increase in peroxidases compared with intact animals. In hypothalamic- pituitary system reduction process is continued. The amount highly functionally active NSC remain on high level in PON up to 233,6% and in ARN up to 242,3%, in b-basophilic adenocytes up to 355,8% and in d-basophilic cells up to 327,8 %, (P<0,001). The amount of moderately functionally active NSC in PON is 72,7% and in ARN is 68,2%, low functionally active NSC in PON is 52,7% and in ARN 43,3%. There is an increase in the amount of destructively changed NSC in PON up to 14,4± 0,5% and in ARN up to 15,2±0,5%.

Thereby, at early post resuscitation period that is during I, II and II stages of the disease, marked compensative adaptive reaction due to increase in activation of SNS and increase in product of POL, decrease in antioxidant system, increase in functional activity HSC in PON and in ARN, as well as in b- and d-basophilic cells of adenohypophysis. Increase in destructively changed NSC, by I.P. Pavlov's expression is a manifestation called "breakdown" and "destruction" of this reaction.

In the course of prolonging the duration of clinical death, takes place increase in functional activities of PON and ARN, also increases in activities of b- and d- basophilic cells of adenohypophysis adenocytes, products of POL and in the amount of destructively changed NSC. There is a decrease in antioxidant system that with time becomes dominating.

Its well-known, that NSC of PON and ARN, as well as b- and d-basophilic cells of adenohypophysis directly take part in regulation of synthesis and secretion of main anabolic hormone testosterone [1]. Accelerated activities of NSC in PON and ARN, as well as b- and d- basophilic cells of adenohypophysis due to prevalence of the tone of SNS and POL, and decrease in antioxidant system, may impact on the course of post resuscitation disease during regenerative stage, that is, to a productive changes in the body at post resuscitation period as the studies had shown for the last couple of years.

Prevalence activity in reactiveness of ANS to the tone of SNS and activation of POL, are directed for adaptation to the stress factors as an activation of cardiac muscles, centralization of blood circulation and increase in muscle tones, as well as lipotrophic effect is directed to a fast adaptive changes in activities of a main lipid dependent membrane proteins that are viable enzymes, receptors and transport ion channels that are situated in cellular membranes [4].

Thereby, in post resuscitation period in animals that undergone 10 minute clinical death, noted specific pathogenic violations in hypothalamus-pituitary system.

In stages I and II of post resuscitation disease due to prevalence in reactivity of PSNS, noted relatively low activity in the product of POL and MDA, decrease in activity of antioxidant systems that are catalases and peroxidases, and emerging of NSC in PON and ARN with karyolysis and plasmolysis. Marked increase in morpho-functional activity of NSC in ARN and d-basophilic cells of adenohypophysis. Coming to the stage III of post resuscitation disease due to prevalence in reactiveness of SNS, there were maximal increases in activities of products of POL and MDA, and maximal decrease in antioxidant system in catalases and peroxidases. In hypothalamic-pituitary system (in NSC of PON and ARN, in b- and d-basophilic cells of adenohypophysis) marked activation in secretion of neuropeptides, glycoproteids. In hyper-hydration of nuclei of NSC in PON and ARN, b-and d- basophilic adenocytes moved toward exhaustion with a rapid decrease in the amount of glycoproteids and neuropeptides due to further increase in the amount NSC with emergence of kariolysis and plasmolysis. Starting from stage IV and in remote period of post resuscitation disease, due to preserving in reactiveness of SNS, there is a insignificantly high level in activities of POL and MDA, further increase in the amount of NSC that have nature in PON and ARN, b- and d-basophilic adenocytes, marked emergence of vicarial compensation in NSC of PON and ARN with a shift toward the exhaustion.

Generalizing all stated data, we can note that in post resuscitation period, in simulation of clinical death with different durations, changes in hypothalamic-pituitary system, reactiveness of ANS and destructive processes can be graded as compensatory adaptive reaction, severity of which depends from duration of clinical death and post resuscitation disease.

7. Conclusions

1. In early post resuscitation period in animals that undergone 10 minute clinical death, during stage I and II of the disease due to reactiveness of ANS prevalence of the tone of PSNS, during stage III tone of the SNS, decrease in activity of antioxidant system in catalases and peroxidases, increase in activities in product of POL and MDA, increase of NSC with high functional activities in ARN and PON, in

basophilic adenocytes with hyper hydration of the cytoplasm, increase in the amount of destructively changed NSC, morpho-functional activity more apparent in NSC of ARN and in d-basophilic adenocytes. Approaching stage III, takes place hyper hydration of nuclei with the shift toward the exhaustion.

2. Starting from stage IV, due to prevalence in reactiveness of SNS, marked regeneration in activities of products of POL and MDA and antioxidant systems in catalases and peroxidases with prevalent activeness of POL. There is a vicarial compensation of NSC in PON and ARN with low level containing in the neuro-secretory substance and low level of glycoproteids in b- and d-basophilic adenocytes. Accordingly, noted increase in the amount of destructively changed NSC with the shift toward the exhaustion.

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