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PECULIARITIES OF STRUCTURAL CHANGES IN THE LIVER, MYOCARDIUM AND KIDNEYS OF RATS AT DIFFERENT AGE UNDER CONDITIONS OF CRANIOCEREBRAL INJURY

Abstract *Morphological changes in the liver, kidneys and myocardium of mature and immature rats were studied 1 hour after mild craniocerebral injury. Clear changes in the type of microcirculatory disorders were found in all the examined organs of mature rats associated with stasis, infiltration, and dilated vessels. In immature rats morphological changes were more expressed and of mainly ischemic and necrotic nature.*

Key words*: craniocerebral injury, histologic examination, morphological changes of the inner organs of immature rats.*

Introduction. *Craniocerebral injury (CCI) is one of the most important issues of modern medicine playing a dominating role in sickness and mortality rates of the population of economically developed countries. The indicated medical problem is multi-disciplinary in the field of practical and experimental medicine and biology, and additionally to medical it is of great social value considering a young age of patients experienced traumatic effects and considerable cost of their treatment [1].*

The WHO estimates in an average 2% increase of annual CCI frequency, and at the beginning of the XXI century the number of people with limited abilities due to traumatic injuries has achieved 5 million [2]. Among all the injuries of childhood CCI is known to constitute 37,6% of cases [3].

Liver and kidney failure and certain pathological changes in the myocardium and lungs are proved to occur more frequently in case of CCI, especially in its acute period.

In spite of the fact that disorders in the internal organs of experimental animals in case of CCI were studied long ago, still dynamic peculiarities of multiple-organ pathology with CCI depending on age remain inconsiderably studied [4].

Objective: to investigate morphological peculiarities of the liver, myocardium and kidneys of mature and immature rats after CCI in the period of acute response to injury (1 hour later).

Materials and methods. The study was carried out on 20 mature (3-month, body weight 180-230 g) and 20 immature (20-day, body weight 20-25 g) albino laboratory rats. Intact groups of comparison of an appropriate age were selected for both groups. Mechanical mild CCI was simulated for rats of both groups by means of a free load fall in the parietal-occipital area of the skill to reconstruct diffuse brain injury; the load of 5 g was chosen for mature rats by the common method [5], and for immature rats – the load of 2 g. 1 hour after CCI the animals were taken out from the experiment by means of euthanasia (inhalation overdosage with ether). The block of organs were fixed in the neutral formalin solution with 10% concentration and 7,5% nitric acid, after that they were dipped into the alcohols of an increasing concentration followed by paraffin-waxy mixture. Microtomic cuts 5 mcm thick were stained with hematoxylin and eosin. The organs were examined microscopically by means of the light microscope «Leica-DMLS» and standard morphometric methods.

Results and discussion. Histologic examination of the liver, myocardium and kidneys performed 1 hour after craniocerebral injury in mature and

immature rats found clear morphological changes. Thus, in the liver of mature rats vascular hyperemia with the signs of diapedetic hemorrhage and hepatocyte disintegration were found (Fig. 1).

In the liver of immature rats 1 hour after CCI ischemic disorders were found manifested by focal areas of empty vessels and well pronounced macrophage and lympohistocytic infiltration (Fig. 2).

The vascular bed of the kidneys of mature rats underwent morphological changes as well with expressed lymphohistocytic infiltration of glomeruli and diapedetic infiltration of the stroma (Fig. 3).

In the kidneys of immature rats 1 hour after CCI more expressed changes were found which manifested by deterioration of the glomerular capsule and their contraction, considerable diapedetic hemorrhages on the border between the cortical and medullary substances, as well as ischemic necrosis of the tubular epithelium and clearly pronounced interstitial swelling (Fig. 4).

In the myocardium of mature rats 1 hour after CCI single myosymplasts are found which is indicative of microcirculatory disorders of the muscle proper and vascular disorders available characterized by dilation of middle and small vessels (Fig. 5).

In immature rats more pronounced morphological changes were found in the myocardium as compared to those of mature rats, which manifested by focal necrosis under the endocardium and spasm of small arterioles and capillaries (Fig. 6).

Many leading specialists consider that in case of craniocerebral injury a number of cerebral-visceral disorders occur which provoke the whole cascade of molecular changes – secondary lesions resulting in hypoxia, release of endogenous irritable amino acids, formation of proinflammatory substances and free radicals.

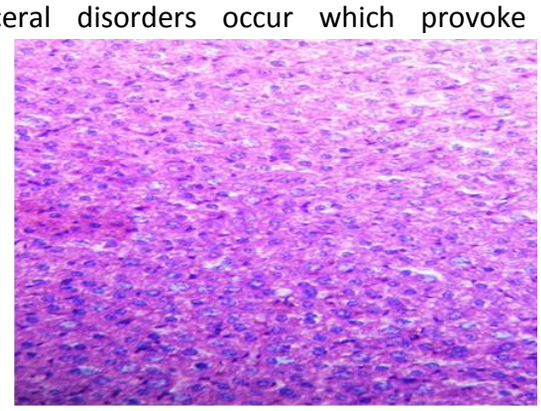

Fig. 1. The liver of the mature rat 1 hour after CCI. Disintegration of hypatocytes. Diapedetic infiltration of the stroma. Staining with hematoxylin and eosin. Magnification x200.

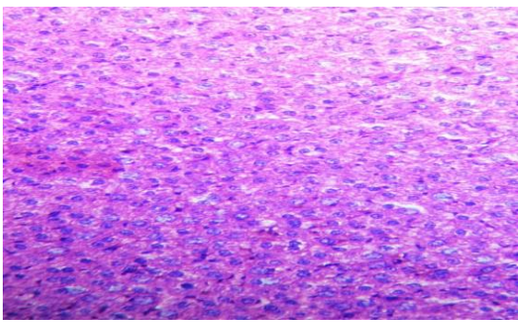

Fig. 2. The liver of the immature rat 1 hour after CCI. Moderate lymphohistocytic infiltration. Hydropic dystrophy. Staining with hematoxylin and eosin. Magnification x100.

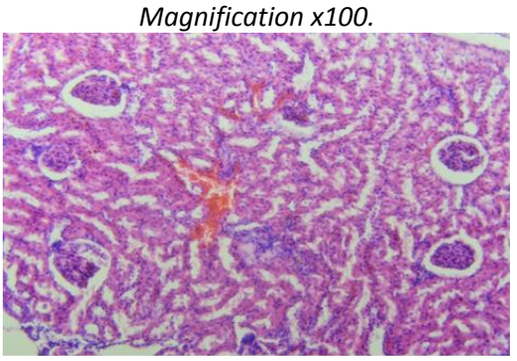

Fig. 3. The kidney of the mature rat 1 hour after CCI. Vascular hyperemia. Diapedetic infiltration of the stroma. Staining with hematoxylin and eosin. Magnification x100.

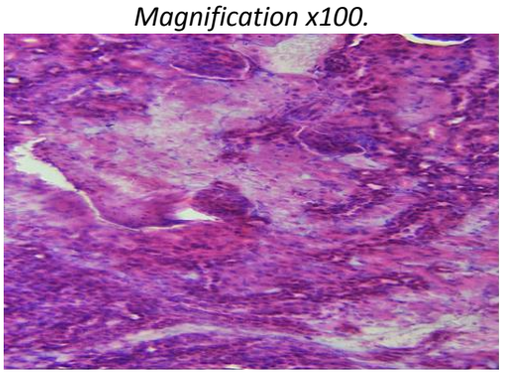

Fig. 4. The kidney of the immature rat 1 hour after CCI. Ischemic necrosis of the tubular epithelium. Clearly expressed interstitial swelling. Staining with hematoxylin and eosin. Magnification x200.

Combination of neurodynamic and destructive processes in different areas of the brain in case of CCI causes functional disorders of the internal organs as well [6-8].

At the same time one should understand that any shock (traumatic) situation is interpreted in the aspect of development of non-specific resistance (protective) reaction of the body, which is similar to adaptation syndrome in an acute phase [4].

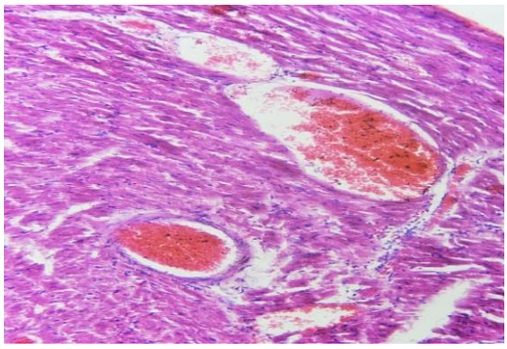

Fig. 5. The myocardium of the mature rat 1 hour after CCI. Single myosymplasts are found. Vascular dilation. Staining with hematoxylin and eosin. Magnification x100.

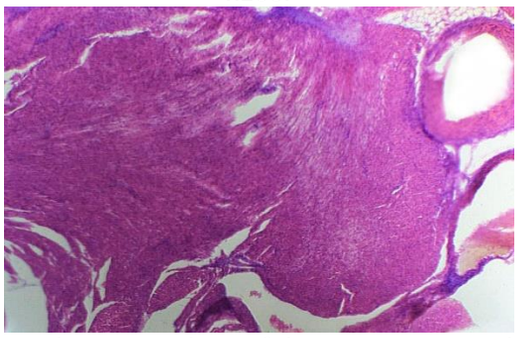

Fig. 6. The myocardium of the immature rat 1 hour after CCI. Spasm of the arterioles and capillaries. Foci of necrosis. Staining with hematoxylin and eosin. Magnification x40.

It was demonstrated that in mature rats after CCI in the period of acute reaction of the body to injury non-specific morphological disorders were found in the parenchymal organs (liver, kidneys, myocardium and lungs) manifested by circulatory disorders with further dystrophic changes [9]. These data in general are similar to those obtained by us. Therefore, not only pathophysiological but non-specific morphological disorders occur during the period of acute reaction. They progress not only in the focus of a direct mechanical lesion, but in different internal parenchymal organs [9, 10].

The literature available does not contain data concerning disorders of immature rats under conditions of CCI. The data obtained in our experiments demonstrate principal differences in the adaptation reaction of immature and mature rats, which enable to carry out further studies of these organs after CCI depending on the time after injury.

Conclusions. Therefore, the results of our investigation demonstrate that in all the examined organs (liver, myocardium and kidneys) after craniocerebral injury in an acute phase (1 hour later) in mature rats specific morphological changes are present in the form of microcirculatory disorders, that is, stasis, infiltration and dilation of vessels. In immature rats morphological changes were more pronounced than those of mature ones. These changes are mostly of ischemic and necrotic character.

Prospects of further studies. Morphological changes in the internal organs of immature and mature rats after CCI depending on the tine after injury will be further studied.

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CONTENT: