Changes in the Morphological Parameters of the Spleen Tissue of Laboratory Rats on 3 Days After a Moderate Traumatic Brain Injury

Annotation: Laboratory studies were conducted on 16 white mongrel rats of 3 months of age. The animals were fixed on a device made by hand in the form of a vehicle on wheels, the fixed animals accelerated on the vehicle and hit the wooden barrier with the frontal part of the head. All laboratory rats were kept in satisfactory conditions. In the vivarium of the medical institute in compliance with the standards of care for laboratory animals. All the rats tested before injury were trained in the Morris water maze, for the preservation of cognitive memory and the acquisition of skills for survival in the water, which was evaluated by temporal and territorial indicators. This experiment was conducted only on animals that received a moderate traumatic brain injury. All laboratory rats after the experiment, by means of instant decapitation of animals, were beheaded on the spot. After opening the abdominal cavity, the spleen was removed. The removed spleen was examined and studied on the spot, as well as its dimensions were measured in accordance with the established procedure.

Key words: spleen, rat, tissues, red pulp, white pulp

Relevance. Traumatic brain injury (TBI) is a collective concept that includes various types and degrees of severity of mechanical damage to both the skull itself and intracranial formations: meninges, brain tissues, cerebral vessels, cranial nerves. In the developed countries of the world, economic and medico-social damage from traumatic brain injury takes the first place. The large proportion of traumatic brain injury (TBI), high mortality and disability of victims, the actual increase in the number of neurotrauma, disappointing data of long-term forecasts place the problem of neurotraumatism in the category of priority [3,4].

The constant increase in neurotrauma, significant disability and high mortality constantly require the study of the medical and social aspects of this problem. For further improvement of organizational measures to provide neurotraumatology care to the population, epidemiological study of this problem is of great importance [2].

At the beginning of the XXI century, traumatism still retains its relevance. The problem of injuries is determined by its prevalence, medical, social and economic significance (high cost of medical care, high mortality and disability rates, significant direct and indirect losses due to the loss of the labor
potential of society). Every year, about 1.5 million people die from various injuries in the world, and 2.4 million become disabled. [4,5]. According to WHO estimates, about 80 million accidents occur annually in the European region. The severity of the injury burden averages almost 2,200 injuries per day, or 90 cases per hour. For each case of death from injuries, there are approximately 30 hospitalizations and 300 requests for outpatient treatment [2,6].

The world's deaths from injury among people of working age, year, years of potential life lost life, caused to society by the total economic and health damage, ranked first in overall mortality (52%), ahead of cardiovascular and neoplastic diseases [1,3,7]. Traumatic brain injury, accounting for 30-40% of the injuries, occupies the first place among the causes of disability and temporary disability, and among the causes of death for people of active age, it is even ahead of cardiovascular diseases and cancer [4,9,12].

In developed countries, injuries in the structure of causes of death of the population follows cardiovascular and oncological diseases, and in terms of the total economic and medico-social damage inflicted on society, TBI ranks first [8,10]. In order to obtain information about the true prevalence of TBI, specially organized population studies are conducted to take into account all cases of traumatic brain injury by the population living in a certain territory. The frequency of the prevalence of TBI varies in different regions of our country and abroad, depends on many factors - more often due to incomplete accounting, due to the lack of registration of victims, and various methods of fixing the injury [11,14].

The medical and social significance of TBI is due to the predominant defeat of the most socially, labor and military active persons; economic damage due to the loss of working time due to temporary disability, the high level and severity of disability of the victims. [8,13]. Intensive study in recent years of various aspects of this type of pathology has led to a revision of previously established ideas about the stability of compensation in patients in the long-term period of TBI. It has been shown that a long period (10-20 years or more) of almost complete clinical compensation in persons who have suffered TBI can be replaced by a significant deterioration in their health, leading to significant restriction of vital activity, social and labor maladaptation, reduction or loss of working capacity [13,16].

Such a comprehensive classification needs to be tested taking into account the improvement of the diagnosis of clinical manifestations of the remote period of TBI and the application of new clinical and expert criteria currently used in solving the tasks of medical and social expertise (ITU). Along with further study of the syndromology of the long-term period of TBI, it is necessary to clarify the causes of disability, social insufficiency and rehabilitation potential of patients in determining disability. [9,12].

Adaptive immunity reactions as well as compensatory immune reactions after injury are a class of protective and adaptive phenomena that develop only in extreme conditions, are a response to damage, can be cascade-type reactions, can compensate for neurological damage. A comprehensive immunological study of victims after injury will allow us to determine the parameters that will help predict the nature of possible complications, reduce the proportion of disability.[12,15].

Materials and methods. The experiment was carried out on 17 white mongrel rats of 3 months of age. The animals were fixed on a device made by hand in the form of a wheeled vehicle, fixed laboratory rats accelerated on the vehicle and hit the wooden barrier with the frontal part of the head.

As a result of this experiment, 1 white rat died on the spot. The remaining 16 laboratory rats were kept in satisfactory conditions of the vivarium of the Medical Institute for 21 days. All 16 laboratory rats were decapitated on the spot after the experiment by means of instant decapitation of animals. After opening the abdominal cavity, the spleen was removed for further examination. All conducted experiments on laboratory animals were carried out in accordance with the Helsinki Declaration of the
International Medical Association of 1964, as well as declarations adopted in 1975, 1983, 1989, 1996, 2000, 2002, 2004, 2008, 2013 years. The removed spleen and its parts were fixed in Buena's solution and placed in paraffin. Subsequently, sections of 6-7 microns in size were prepared and stained in solutions of hematoxylin-eosin and van Gieson. Morphometric studies were carried out on the NLCD NOVEL-307B microscope (China)

Research results. Morphological and morphometric features of the spleen of rats who received a severe traumatic brain injury three days after the injury. On examination, periartrial lymphatic couplings (PALM) and lymphoid nodules (LU) gave the following results. PALM diameter ranges from 86.2 microns to 105.6 microns, with an average of 96.88±1.48 microns. The diameter of the lymph node ranges from 323.5 microns to 456.05 microns, on average 391.1 ± 11.32 microns. Lymphoid nodules can be visually divided into primary and secondary, which percentage ratio is 15% and 85%, respectively. In secondary LU, the formed germinative centers are determined. The diameter of the germinal centers ranges from 88.6 microns to 116.2 microns, on average 107.4 ± 6.84 microns. Large LU, often merge. The LU of the white pulp of the spleen mainly has a rounded, oval and elongated shape.

Sometimes there are cases of indistinct separation of sections of white pulp. But in the main cases, the LU zones are clearly distinguishable. The width of the mantle zone ranges from 72.2 microns to 96.32 microns, with an average of 79.96±0.83 microns. The width of the marginal zone ranges from 60.4 microns to 87.3 microns, with an average of 69.87± 1.58 microns. The width of the periarterial zone ranges from 87.1 microns to 91.9 microns, with an average of 84.17 ± 0.63 microns. It was found that the total number of lymphocytes in the LU without breeding centers is 41-52, on average - 50.1 ± 0.78 cells. Lymphoid nodules without reproduction centers contain (per unit area) small lymphocytes - 33-38, on average - 36.1 ± 0.71 cells, medium lymphocytes - 19-28, on average - 15.75 ±0.18 cells and large lymphocytes -3-4, on average - 3.2 ± 0.1 cells.

The total number of lymphocytes in the periarterial lymphoid couplings of the white pulp of the spleen is 52-61, on average - 56.6 ± 1.1 cells. Periarterial lymphoid couplings contain (per unit area) small lymphocytes -32-38, on average - 35.7±0.71 cells, medium lymphocytes - 13-18, on average - 15.75 ±0.18 cells and large lymphocytes -3-4, on average - 3.2 ± 0.1 cells.

<table>
<thead>
<tr>
<th></th>
<th>Lymph node</th>
<th>Paraarterial lymphatic coupling</th>
<th>Germinative Center</th>
<th>Mantle zone</th>
<th>Marginal zone</th>
<th>Periarterial zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORMA</td>
<td>466.1±12.4</td>
<td>120.1±1.5</td>
<td>135.4±6.65</td>
<td>48.31±0.81</td>
<td>77.14±1.32</td>
<td>85.04±0.69</td>
</tr>
<tr>
<td>After traumatic brain injury 1 day</td>
<td>381.4±13.8</td>
<td>92.88±1.48</td>
<td>102.4±6.4</td>
<td>82.65±0.82</td>
<td>68.14±1.63</td>
<td>77.04±0.69</td>
</tr>
<tr>
<td>After traumatic brain injury 3 day</td>
<td>391.1±11.3</td>
<td>96.88±1.48</td>
<td>107.4±6.84</td>
<td>79.96±0.83</td>
<td>69.27±1.58</td>
<td>78.17±0.63</td>
</tr>
<tr>
<td>After traumatic brain injury 7 day</td>
<td>399.4±12.8</td>
<td>99.24±1.31</td>
<td>109.4±6.27</td>
<td>71.41±0.81</td>
<td>70.87±1.14</td>
<td>79.26±0.63</td>
</tr>
<tr>
<td>After traumatic</td>
<td>408.9±10.9</td>
<td>102.26±1.42</td>
<td>114.2±6.32</td>
<td>64.21±0.78</td>
<td>71.17±1.1</td>
<td>80.36±0.68</td>
</tr>
</tbody>
</table>
The table shows the morphometric parameters of the structural components of the white pulp of the spleen in severe traumatic brain injury.

**CONCLUSIONS.** The conducted research allows us to conclude that in existing cases of traumatic brain injury of animals, in this case laboratory mongrel rats, on the third day after the injury also lead to noticeable changes in the structure of the spleen. A decrease in the size of lymphatic follicles, germinal centers, palms, mantle and marginal zones by almost 25-30 percent and an increase in the size of the mantle zone by almost 30-35 percent from the normative indicators. There is also a partial emptying of the germinal centers of most lymphatic follicles.

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