

MORPHOLOGICAL EVALUATION OF THE EFFICIENCY OF THE LOCAL HEMOSTATIC DRUG "HEMOBEN" IN DAMAGE TO THE DURAL MEMBRANE AND BRAIN SUBSTANCE IN THE EXPERIMENT

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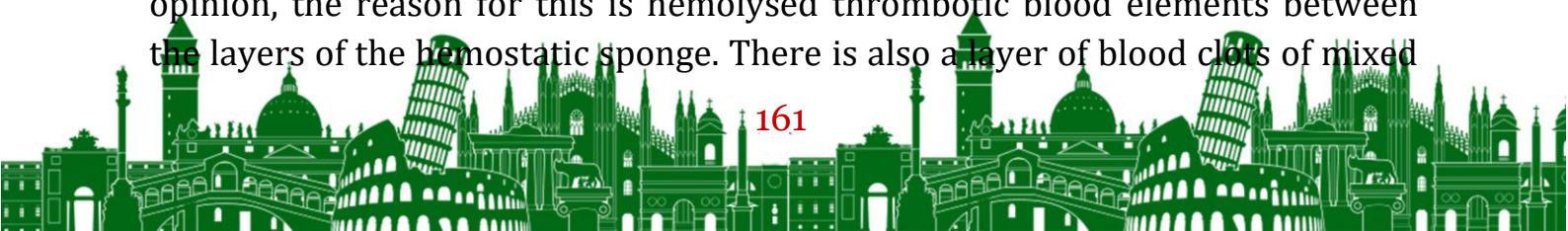
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Relevance. Surgical interventions on the brain are characterized not only by the need for targeted topical work, but also by the likelihood of high bleeding of the tissue, requiring the use of additional measures to achieve adequate hemostasis. It was the factor of improving the efficiency of hemostasis that served as the main purpose of the study. Taking into account the fact that in neurosurgery, the study of the effectiveness of the new domestic drug "HEMOBEN" is being conducted for the first time, we did not focus on the functional results of operations, but took into account the hemostatic effect of the drug in the parenchyma and vessels of the soft membrane of the brain, as well as in the dura mater. In our practice, a hemostatic sponge is often used, and therefore a comparative assessment was carried out between these two means – "HEMOBEN" and a collagen hemostatic sponge.

Material and methods of research. Rats were selected as experimental animals. The animals were monitored for 21 days. Their mobility and reactions to external stimuli were taken into account. In the control group of rats for 6-8 days, there was a slight decrease in activity while maintaining an adequate response to external stimulation. In the experimental group – in dynamics without much change – they are active, mobile, with an adequate response to external stimulation.

The results of the study. Morphological studies were initiated starting from 3 days after hemostasis in the area of experimental brain wounds. For clarity of comparison, sections of the brain of rats from the control and experimental groups are given.

On day 3, the main visual sign in the wound area was swelling and an increase in the size of the hemostatic sponge in the control group. In our opinion, the reason for this is hemolysed thrombotic blood elements between the layers of the hemostatic sponge. There is also a layer of blood clots of mixed



composition in the area of the sponge and wound. For this reason, it tends to rise above the wound area and easily move away from the wound.

The control group retains a necrosis site surrounded by a leukocyte shaft in the parenchyma, thinning of the soft meninges, secondary vascular changes due to hemodynamic disorders, areas of neuronal prolapse.

In the experimental group, mainly in the area of damage, the vessels of the soft meninges are full-blooded and there is a developed stasis. There are no thrombus layers consisting of various blood elements in the layers. Sufficient blood filling of vessels, the state of the brain substance without any gross morphological changes. Poorly developed edema. The cellular layers of brain tissue are clearly differentiated in the layers.

On the 7th day in the control group there were areas of necrosis, infiltration, kareopycnosis, loss of neurons, swelling in the parenchyma. On a slice of the cortex, neurons are hyperchromic, reduced in size, perivascular and perineuronal spaces are enlarged – edema and dystrophy are observed. In the vascular plexuses of the lateral ventricles – violation of hemodynamics, edema, expansion of vascular spaces. In the experimental group, these changes are less pronounced.

On the 15th day in the control group: leukocyte infiltration around necrosis sites in the parenchyma. In the molecular layer – pronounced vacuolization, kareopycnosis, a decrease in the number of cells. Secondary hematomas, as a result of hemodynamic disorders. The reason for this, in our opinion, is mainly due to repeated bleeding from the wall of damaged vessels of the parenchyma, the soft meninges, as well as the dura mater, where the blood was stopped with a hemostatic sponge. The hemostatic property of the hemostatic sponge is due to the squeezing action of the vessels, which, when this effect disappears, may be the cause of secondary hematomas.

In the experimental group, mild dystrophic changes occur mainly in the layers of the brain tissue of the affected area. Signs of hemostasis - intravascular stasis and sludge persist in vessels affected by the soft meninges in the area of injury. The damaged layers began to recover.

On the 21st day in the control group: areas of necrosis are preserved. A clearly developed demarcation zone of inflammation remains. Dystrophic changes in neurons and glial cells persist. The vessels of the soft meninges of the brain in the area of injury are dilated to varying degrees. Connective tissue began to grow between them. The volume of functional vessels is relatively



smaller. The elements of the hemostatic sponge are preserved. Blood clots consisting of bloody infiltrates are found among them.

In the experimental group, tissue regeneration in the area of injury is clearly observed. New blood vessels began to appear in the affected areas of the soft meninges. At this time, proliferative processes of inflammation prevail.

On the 28th day in the control group, these changes are joined by an increase in the number of macrophages in the focus. Coarse connective tissue fibrous tissue is detected in the area of the soft meninges of the brain. Hemostatic spongy elements are determined. Hydrolysis and destruction as a result of various macrophage reactions are observed in them.

On the 35th day, it can be seen that the cell composition in the control group is significantly reduced compared to the experimental one, the layers of the cortex are less distinguishable, perineuronal and perivascular edema, foci of neuronal prolapse, and a thin soft meninges remain. Normalization of the structure of the brain substance is observed, although edema and loss of neurons persists.

In the experimental group, by this time, the complete restoration of histological layers had been completed. Fine fibrous changes and new vessels are formed in the vessels of the brain. Perineuronal and perivascular edema is not observed.

Conclusions. 1. Experimental studies have shown that the use of a hemostatic sponge to stop bleeding from brain tissue and dura mater requires prolonged fixation, and the final hemostasis was observed for more than 2 minutes (2.3 ± 0.6 minutes). The use of HEMOBEN powder made it possible to shorten the period for achieving hemostasis to 40 seconds (0.38 ± 0.11 minutes; $t=3.15$; $P < 0.001$).

2. It should be noted that when large venous vessels were damaged, it became necessary to change the collagen coating 2-3 times, and when using HEMOBEN powder, its amount doubled.

3. In contrast to the hemostatic sponge in the postoperative period, a more favorable course was noted in the experimental group of animals, since the process of resorption of the powder is not accompanied by an inflammatory reaction of tissues, wound healing with regression of cerebral edema occurred by 7-13 days, whereas the hemostatic sponge has a longer period of resorption, in connection with which the risk of attachment significantly increases secondary infection, and the healing process is delayed up to 21 days or more.





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