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EXPERIMENTAL MODELLING OF TRAUMATIC BRAIN INJURY IN WHITE RATS

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✓ ***Resume,***

Traumatic brain injury has already received the status of a" new epidemic " in the health sector. In an experiment by scientists from around the world in recent years, many have modeled brain injuries. But nevertheless, the head injuries that occur in humans are not fully reflected in the experiments. In the experiment, we caused brain injuries in white rats by horizontal percussion. Here, a craniocerebral injury was modeled, similar to the injury caused by a car accident observed in humans.

Keywords: traumatic brain injury, modeling, white rats, horizontal shock model, motor and cognitive changes.

ЭКСПЕРИМЕНТАЛЬНОЕ МОДЕЛИРОВАНИЕ ЧЕРЕПНО-МОЗГОВОЙ ТРАВМЫ У БЕЛЫХ КРЫС

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✓ ***Резюме,***

Черепно-мозговая травма уже получила статус "новой эпидемии" в секторе здравоохранения. В эксперименте ученых со всего мира в последние годы многие моделировали травмы головного мозга. Но тем не менее травмы головы, которые происходят у человека, не полностью отражены в экспериментах. В эксперименте мы вызывали травмы головного мозга у белых крыс горизонтальным ударном способом. Здесь была смоделирована черепно-мозговая травма, схожая с травмой, вызванной автомобильной аварией, наблюдавшейся у человека.

Ключевые слова: черепно-мозговая травма, моделирование, белые крысы, горизонтальная ударная модель, двигательные и когнитивные изменения.

ТАЖРИБАДА ОҚ КАЛАМУШЛАРДА БОШ МИЯ ШИКАСТЛАНИШИНИ МОДЕЛЛАШТИРИШ.

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✓ ***Резюме,***

Травматик бош мия шикастланиши аллақачон соғлиқни сақлаш соҳасида "янги эпидемия" мақомини касб этди. Охирги йилларда дунё олимлари томонидан тажрибада кўп маротаба бош мия шикастланишлари моделлаштирилган. Аммо шунга қарамасдан, инсонда юз берадиган бош мия шикастланишлари тажрибаларда тўлиқ акс этмаган. Биз тажрибада горизонтал усулда оқ каламушларда бош мия шикастланишларини чақирдик. Бунда инсонда кузатиладиган автоҳалокат туфайли келиб чикадиган бош мия шикастланиши моделлаштирилди.

Калит сўзлар: травматик бош мия шикастланиши, моделлаштириш, оқ каламуш, горизонтал зарба модели, ҳаракат ва когнитив ўзгаришлар.

Relevance

Traumatic brain injury (TBI) has already received the status of a "new epidemic" in the health sector. Most often, this can be obtained during sports, car accidents, domestic violence, or military exercises. Damage to the central nervous system can trigger molecular cascades at the

cellular level. Many people can get a mild injury and recover in a short time, but repeated seizures can have long-term consequences associated with several factors. Traumatic brain injury is the main cause of disability among the population [1,4,6]. Unsuccessful treatment, an abundance of disabilities require new examination and treatment procedures. Recommendations for the experimental method do not justify themselves in brain injuries. Therefore, in experimental animals, it is important to study changes in internal organs by modeling brain damage [3,5]. The scientific literature shows several types of modeling of brain injuries. But so far, no experiment can fully reflect the brain damage observed in humans [2,4,8].

Materials and methods

Modeling TBI in rats [Fig.1]:

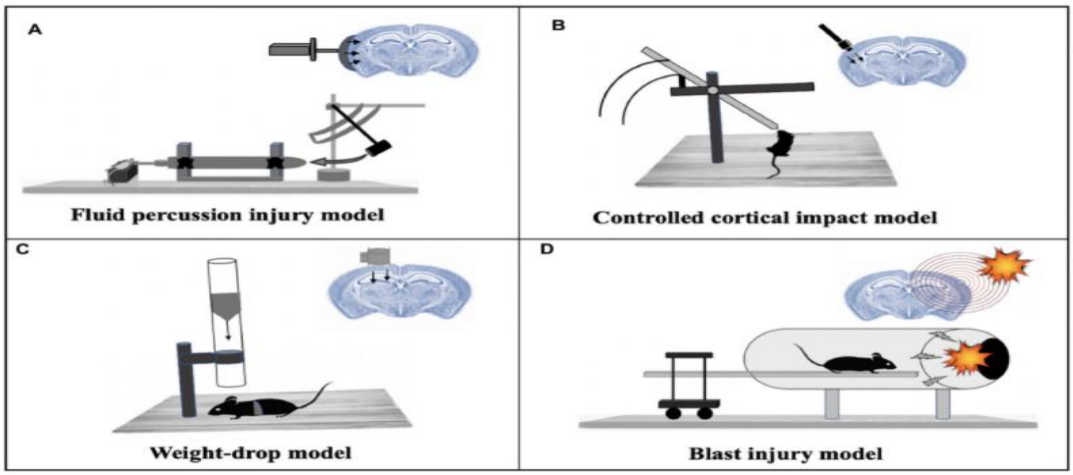
Liquid—percussion brain injury - in this model, the injury is caused by the force of a pulsed wave of fluid on the dura mater, which does not break through the trepanation defect, which leads to short-term deformation of the brain tissue [6,7].

Controlled cortical impact - in this model, the damage is caused by the mechanical force of air or the impact of a metal piston on the solid membrane of the brain [1,3].

Blast - related injury model - a device for simulating such an injury consists of a large-diameter tube in which a rat explodes at one end and a small part of the explosive at the other end [2,7].

The falling load model (weight drop-impact acceleration injury) - the focal effect on the animal's brain is created by a free-falling weight on the head directed at the tube [5].

Figure 1. Modeling methods.



And in TBI, which is observed in life, most often in falls from a height and in car accidents, brain damage occurs as a result of a collision of the victim's moving head with a barrier. Based on this, we developed a model of horizontal impact of TBI, simulating an injury as a result of a car accident. In people with injuries from car crashes, TBI is often linear and occurs as a result of acceleration or deceleration of rotation. This clinical scenario was reproduced by us in a special device in the experiment as follows. The rat is placed in a cart, and the animal's head is attached to the headrest. It moves along a special rail that is lowered into the rat cart, creating a barrier for the animal's head to collide on this road. By changing the angle of descent of the tracks and the weight of the cart, the severity of TBI that occurs in rats is regulated [Fig.2].

Figure 2. Horizontal impact model.

The study was conducted on 20 laboratory white rats weighing 180-200 g of both sexes, 2 months of age. The rats were divided into 2 groups. The first control group consisted of 10 rats that were not injured. The remaining 10 rats of the second experimental group under light inhalation anesthesia with isoflurane were inflicted with mild and moderate injuries using the above method. At the same time, the length of the rail to the barrier was 1.5 meters, the angle of incidence was 30°.

Results and discussion

The proposed method investigated the mobility and cognitive characteristics of white rats to evaluate the results of TBI. "Movement on a bar" method mainly determines the coordination disorders of motor function, which is typical for mild and moderate traumatic brain injury. Rats of the experimental group were treated with mild and moderate TBI. A day after the injury, a study was conducted on rats of both groups to assess their motor disorders using the "movement on a bar" method. The study was conducted on rats of both groups on a narrow bar with a width of 2.0 cm, a length of 150 cm, which is installed in a special wooden box. On one side was a bright light, and on the other side was a dark shelter for rats. The animals ' ability to balance and move on the bar was evaluated using video recording. The rats were given the "walking on a bar" method to notice that the coordinate of movement had changed. The rats of the experimental group had a disturbed balance when walking on the board compared to the control group. Cognitive impairment was determined by evaluating spatial learning and memory in the "Morris Water Maze". The Morris Water Maze was used to assess spatial learning and memory by training rats to detect a hidden, submerged underwater platform using visual information. The device used consists of a large circular pool (diameter 170 cm, height 60 cm, water temperature 24 ± 1°C) with a platform with a diameter of 10 cm, submerged 3 cm below the water surface. The platform becomes invisible with the addition of small foam crumbs to the surface of the water. The rats developed a conditioned reflex of finding the platform before the injury. A day after the injury, the rats of both groups underwent a study in the Morris water maze and evaluated the animals ' ability to remember the location of the platform with video recording. As for the experimental group of rats, after an injury, the amount of memory is lost and the process of searching for a platform is delayed.

Conclusions

Despite the many methods of modeling TBI, none of them can fully reflect all aspects of TBI in humans. Each model has its own advantages and disadvantages. All of the above models of TBI are affected by the vertical force of mechanical damage on the head of the rats in the experiment. In our proposed model, the moving body of a rat hits its head on an obstacle and receives many natural brain injuries inherent in humans. In our model, TBI is caused due to the horizontal impact effect of traumatic force. This method also has disadvantages like other methods. After this method, the death of experimental animals is great and craniocerebral trauma is combined with injuries to the skeleton of the face and neck. This model helps us study the combined

traumatic brain injury that is often seen in humans.

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