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Macroscopic Features of the Adrenal Glands of White Rats after Traumatic Brain Injury

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Abstract: Along with structural and functional changes in the central nervous system, purulent-septic complications, hemostasis disorders, after traumatic brain injury, one of the leading places is occupied by endocrine disorders of the hypothalamic-pituitary-adrenal system with combined changes in the structural and functional state of the adrenal glands. Studies conducted with laboratory rats allow us to conclude that in severe cases of traumatic brain injury ending in death, the animals, in this case white outbred rats, lead to virtually no visible macroscopic changes in the adrenal glands and organs nearby.

Keywords: traumatic brain injury, adrenal glands, macroscopic features, topography, abdominal cavity.

Relevance: One of the problems of the modern world, the most important social and medical problem with the large-scale implementation of modern technologies, with a high frequency of road accidents, is not only traumatic brain injury, but also complications and consequences that arise after suffering a traumatic brain injury. The relevance of studying changes in endocrine organs is due to the importance of this system in maintaining homeostasis of the body [1,4].

Traumatic brain injury (TBI) accounts for about 30-40% of the injury rate and is one of the main causes of disability and loss of ability to work for a large proportion of victims. Traumatic brain injury is the leading cause of death in people under 35 years of age. The number of deaths among active young people from traumatic brain injury exceeds the number of deaths from cardiovascular diseases and cancer. There is an increasing number of publications devoted to endocrine disorders after TBI, as it has been revealed that the latter have a significant impact on the survival and quality of life of patients. [4,5]. It has been proven that an important link in the pathogenesis of traumatic brain injury is endocrine, in particular hypothalamic-pituitary-adrenal changes, caused by morphological and functional disorders of nonspecific brain systems. These defects can be both compensated and uncompensated, reversible and irreversible, which largely determines the prognosis of the disease, in particular its death [1,2]. Interest in studying the structure of the pituitary gland and adrenal glands in TBI is due to the great importance of these glands in maintaining homeostasis and providing a nonspecific protective reaction of the body [3,4]. A lot of publications are devoted to the fact that the pathogenesis of traumatic brain injury (TBI) includes not only mechanical damage to brain tissue with the destruction of vital centers, but also plastic and energetic restructuring of the endocrine system, affecting both its regulatory departments and peripheral glands [1,5].

Purpose of the study. The purpose of this study is to determine the impact of traumatic brain injury on changes in the morphological parameters of the adrenal glands, which will allow us to deepen our understanding of the mechanisms of adequate response of the adrenal glands to the influence of exogenous factors and the order of possible sequential changes in the morphological parameters of this organ. The article provides information on the results of scientific research that allows us to evaluate and to study the features of macroscopic topography of the adrenal glands of 3-month-old rats with severe brain injury. The injury was performed using the Road Traffic Accident model, and the rat adrenal glands were isolated and examined in the order in which the anatomical parameters were established.

Materials and methods: The material for this study was 16 clinically healthy white outbred rats of both sexes, 3 months of age, weighing from 110 to 120 g, raised in cage conditions in a vivarium with a standard diet, free access to water and normal lighting mode. Work with laboratory animals was carried out in compliance with the basic regulatory and ethical requirements for conducting laboratory and other experiments. In this experiment, animals were fixed on a hand-made device in the form of a vehicle on wheels, the secured laboratory rats were accelerated on the vehicle and hit a wooden barrier with the frontal part of the head, which led to brain injury. As a result of this experiment, 16 white rats died on the spot. During the experiment, 16 rats were decapitated at the scene on the same day. The wide range of well-known anatomical experimental research methods we used included: dissection, examination of the morphological object and its description (color, consistency, shape), identification of topographical features taking into account syntopy, outline of the organ along its contours, photography, which ultimately allowed us to conduct a thorough macroscopic examination of the adrenal glands of rats. Before the start of the experiment, we selected complexes of macromorphological criteria reflecting the organ-specific features of the most important morphofunctional structures of the adrenal glands under study.

Research results. When examining the abdominal cavity, it was revealed that the rat's adrenal glands are asymmetrical in shape, yellowish in color, located retroperitoneally in the thickness of the perirenal fatty tissue of the lumbar region of the corresponding halves of the abdominal cavity. The lateral sections of each gland interact with the craniomedial ends of the kidneys. The adrenal glands are divided into a ventral surface facing the abdominal cavity, as well as a lateral and medial surface.

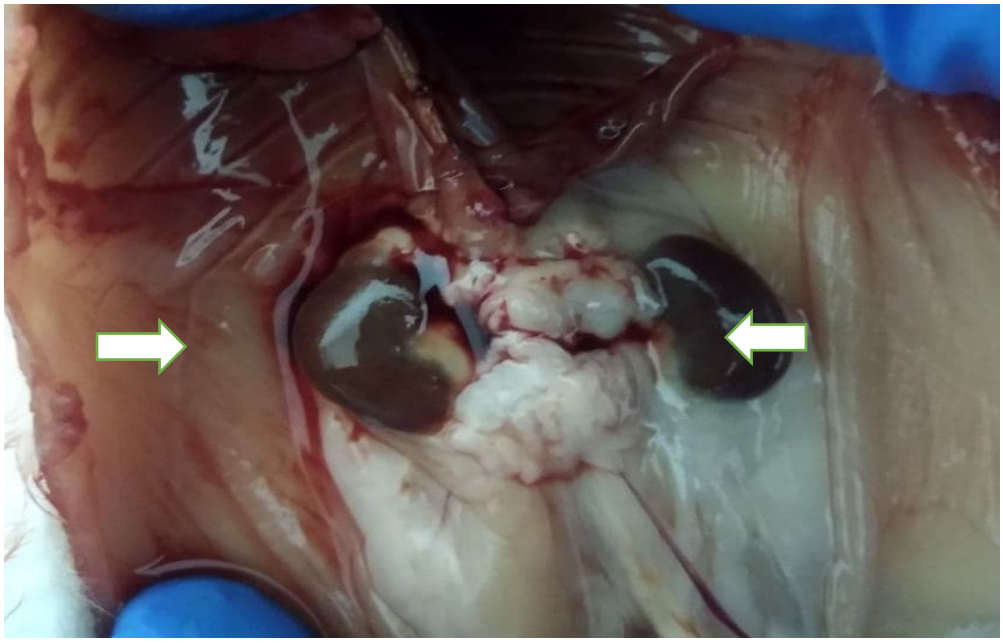

Figure 1. Topography of the adrenal glands of a 3-month-old rat.

The left adrenal gland is irregularly oval in shape, slightly elongated along the spinal column. The cranial end of the organ is convex-oval, and the caudal end, taking into account the right-sided asymmetry, is widened. The middle part of the gland is slightly narrowed. The right gland resembles a crescent in shape, with its ventral surface facing the abdominal cavity. It is irregularly oval in shape and caudally narrowed. Along it along the middle sagittal there is a formed groove. In accordance with the shape of the right gland, its cranial part is curved dorsally and is in close contact with the ventral lumbar muscles and the craniomedial surface of the corresponding kidney.

It was also noted that, despite the traumatic brain injury received during the experiment, which was incompatible with the life of the animal, the location of the adrenal glands relative to nearby organs was without any visible damage or changes on both sides.

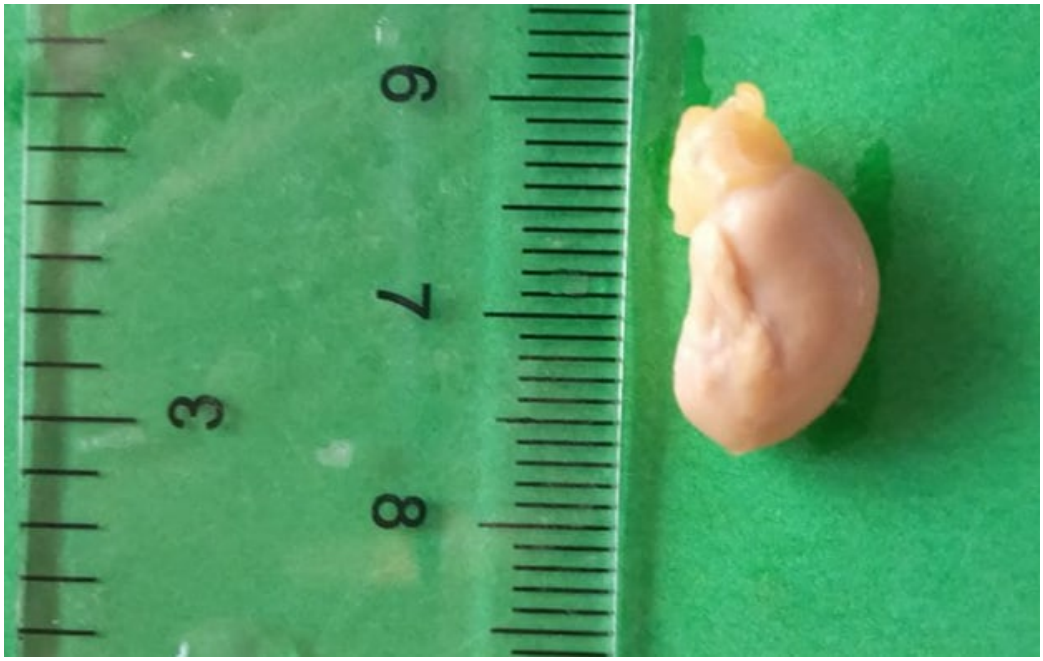

Figure 2. Dimensions of the right adrenal gland.

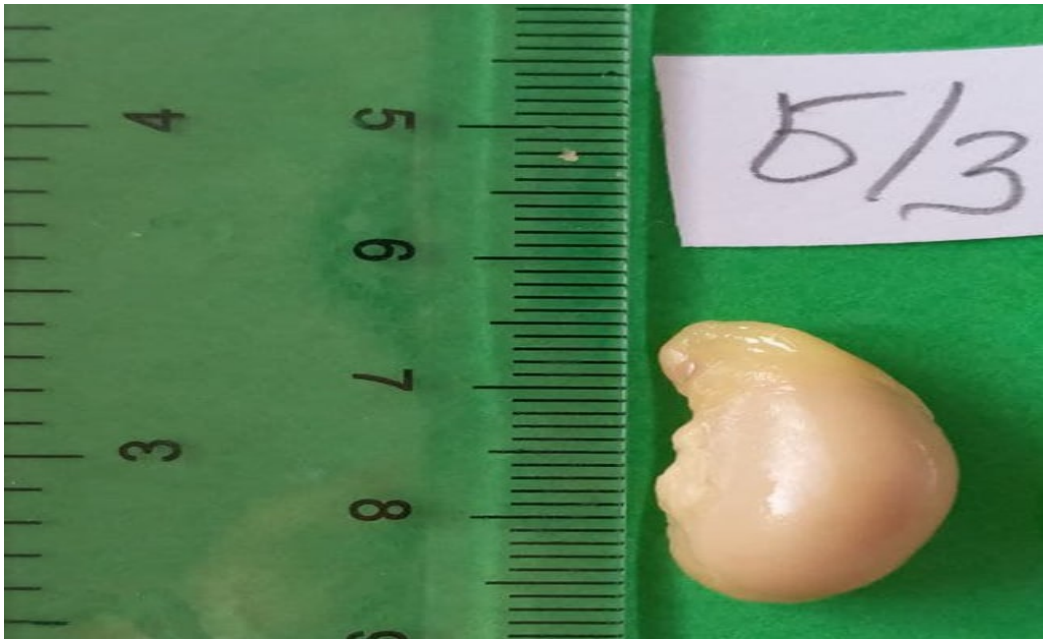

Figure 3. Dimensions of the left adrenal gland.

Conclusions. Studies conducted with laboratory rats allow us to conclude that in severe cases of traumatic brain injury ending in death, the animals, in this case white outbred rats, lead to virtually no visible macroscopic changes in the adrenal glands and organs nearby.

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