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Morphometric Studies of the Testes of White Mongrel Rats in the Acute Stage of Traumatic Brain Injury

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Abstract: 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. It is known that almost all internal organs and tissues suffer from traumatic brain injury. Thus, morphological changes that occur during traumatic brain injury in various parts of the brain - hypothalamus, pituitary gland, organs of the cardiovascular system - have been studied in some detail. The endocrine glands, including the sex glands, undergo significant changes in traumatic brain injury.

Keywords: traumatic brain injury, testes, morphometry.

In patients with traumatic brain injury, disorders of the function of the genital glands are of a central nature and have clinical signs of pituitary insufficiency of a neuroendocrine or vegetative-vascular nature (1). As is known, the anterior lobe of the pituitary gland synthesizes a number of peptide hormones: adrenocorticotropic hormone, thyroid-stimulating hormone, luteinizing hormone, follicle-stimulating hormone, lactotropic hormone and somatotropic hormone.

Pituitary secretion, in turn, is regulated by the hypothalamic release of releasing factors on the one hand, as well as with the secretion of neurohypophysial hormones on the other. Pituitary dysfunction leads to the development of complex diseases. In TBI, endocrine dysfunction is observed from 15% to 68% of cases. Injuries to the anterior pituitary lobe are recorded in 27.5% of cases with various types of TBI. At the same time, after this injury, insufficiency of luteinizing hormone, follicle-stimulating hormone and growth hormone is most often found. Biopsies of the genital glands in patients with this kind of pituitary disorders show morphological signs of secondary hypogonadism.

Specialists have made a great contribution to the study of the morphology of the male sex glands and the causes of male infertility (2). Despite the successes achieved in the diagnosis of male reproductive function disorders in a third of patients examined for infertility, it is not possible to establish a specific cause of this pathology (3). For the final verification of nosology, its variants and the degree of lesion, in severe azoospermia and oligozoospermia of various etiologies, a morphological examination of testicular tissue is performed. The analysis of histological preparations includes an assessment:

- histological changes in each individual seminal tubule by separately counting the number of available cells (spermatogonia, spermatocytes, rounded and elongated spermatids, sustentocytes);
- the state of its own plate (basement membrane);
- condition and composition of interstitial tissue.

So, if the number of elongated spermatids is reduced in the seminal tubules or an incomplete cellular composition is observed, then we are talking about "hypospermatogenesis".

The stoppage of spermatogenesis, characterized by the presence of early rounded spermatids, primary spermatocytes or spermatogonies in all tubules, is designated by the term "maturation stoppage". Similar changes were found in 12.5% of the studied observations.

An important stage of microscopic examination of a testicular biopsy is a quantitative assessment of the degree of spermatogenesis disorders. For the first time such a scoring system for assessing the quality of spermatogenesis was proposed in 1970 by S. Johnsen and modified by De Kretser and A.

Holstein (6). According to this system, each convoluted seminal canal is evaluated on histological preparations, to which a certain score is assigned. Such a system is most significant for patients with oligozoospermia. However, in non-obstructive azoospermia, the score indicates only the average number of tubules with an altered number of spermatogenic cells, and does not allow recording abnormal spermatogenic cells: elongated or giant, as well as multinucleated spermatids. In this regard, according to some authors, the most acceptable is the score scale proposed in 1998 by M. Bergmann and S. Kliesch, according to which the percentage of tubules containing elongated spermatids is calculated on histological preparations (7).

Based on the obtained values (percent), the severity of epithelial atrophy of the testicular seminal tubules is determined. If elongated spermatids are detected in 75% of tubules or more, then we are talking about normal spermatogenesis. When spermatids are detected in 10-74% of tubules, mixed atrophy of the epithelium of the seminal tubules is indicated. If less than 10% of the tubules contain elongated spermatids, then pronounced testicular atrophy is diagnosed.

There is a known method for diagnosing hypospermatogenesis and atrophy of spermatogenic testicular cells by conducting a morphometric analysis of a biopsy by determining the index of spermatogenesis, which is the ratio of the number of all spermatogenic cells to the number of sustentocytes (Sertoli cells) in 30 cross sections of convoluted seminal tubules (8). It includes:

1. Testicular biopsy (according to indications).
2. Morphometric examination of the biopsy, including the counting of sustentocytes on 30 cross-sections of the seminal tubules of the histological preparation. In the same tubules, the total number of spermatogenic cells is calculated.
3. The spermatogenesis index is calculated as the ratio of sustentocytes / cells of spermatogenesis.

The result is evaluated according to such signs as: a decrease in the spermatogenesis index to 10-90%, a decrease in the spermatogenesis index of more than 90%, while in 1 case hypospermatogenesis is diagnosed, in 2 cases atrophy of spermatogenic testicular cells is diagnosed. The spermatogenesis index was successfully used in the morphological diagnosis of disorders of spermatogenesis in atherosclerosis, inguinal hernia, acute mumps orchitis in adults, varicocele (9,21,23).

The complete absence of spermatogenic cells in all tubules available on the drug and the presence of sustentocytes in them is the basis for the diagnosis of "Sertoli cell-only syndrome".

In the absence of spermatogenic cells and sustentocytes, in combination with thickening of the basal membrane of the tubules due to the deposition of amorphous material in it, the term "hyalinization of the tubules" or "shadows of the tubules" is used [10].

Anomalies of nuclei in the form of multinucleated spermatids indicate violations of spermiogenesis and spermatogony or defects of meiosis, manifested in the form of megalospermatocytes [11]. An important morphological criterion is the shape of the nuclei of sustentocytes. Some authors note that if the nuclei of sustentocytes have a rounded or oval shape, then they should be regarded as "immature" (apparently - poorly differentiated). "Mature" (more differentiated) have uneven outlines of nuclei with deep invaginations, then such cells should be regarded as immature.

Immature prepubertal sustentocytes are more clearly detected by immunohistochemical methods by the expression of anti-Muller hormone and very low proliferative activity in them (12, 13).

When describing the intercanular tissue, the state of the microcirculatory bed and the ratio of Leydig cells, fibroblasts, macrophages should also be evaluated. Thickening of the intima and sclerosis of the outer lining of blood vessels indicate arteriosclerosis and can be combined with oligozoospermia.

Damage and degeneration of interstitial endocrinocytes also often accompany disorders of spermatogenesis. At the same time, diffuse or focal hyperplasia of interstitial endocrinocytes in interstitial tissue was detected in patients with non-obstructive azoospermia, which, according to previously published data, is one of the causes of hormone level disorders (14,15).

Conclusion: Morphological analysis of various types of spermatogenic cells of the seminal tubules of experimental animals allows us to identify a number of variants of spermatogenesis disorders in traumatic brain injury, which proves the effect of trauma through the hypothalamic-hypaphyseal-gonadal axis.

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