HISTOLOGICAL CHANGES IN THE NERVES OF THE TOOTH-JAW SYSTEM OF IRRADIATED MICE IN THE EXPERIMENT

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Abstract. In this article, in the experiment, rats were exposed to X-rays, followed by resection of the ileum, and histological changes in the autonomic nerve ganglia of the intestine were studied. Initially, reactive changes occur in the solar plexus and intramural nerve fibers of the intestine, followed by degenerative changes.

Keywords: rat, X-ray, autonomic ganglion, solar plexus, small intestine, Bilschowsky method, Nissl method.

ГИСТОЛОГИЧЕСКИЕ ИЗМЕНЕНИЯ НЕРВОВ ЗУБО-ЧЕЛЮСТНОЙ СИСТЕМЫ ОБЛУЧЁННЫХ МЫШЕЙ В ЭКСПЕРИМЕНТЕ

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Аннотация. В данной статье в эксперименте крысы подвергались воздействию рентгеновских лучей, а затем резекции подвздошной кишки, и изучались гистологические изменения в вегетативных нервных ганглиях кишечника. Первоначально возникают реактивные изменения в солнечном сплетении и интрамуральных нервных волокнах кишечника, затем следуют дегенеративные изменения.

Ключевые слова: крыса, рентген, вегетативный ганглий, солнечное сплетение, тонкий кишечник, метод Бильшовского, метод Ниссля.

Introduction. In clinical examinations, a number of researchers have identified damage to the teeth and periodontium (development of caries, tooth loss,

spontaneous jaw fractures) in individuals exposed to chronic effects of small doses of radiation in production conditions or those who have been in prolonged contact with radioactive substances during the work process [1,6,7]. In this case, a decrease and disruption of taste sensations, a reduction in the reaction of the oral cavity mucosa to pain and temperature stimuli, and increased sensitivity have been observed [2,5]. However, in the literature known to us, there was no information on the structural reaction of the nerve elements of the tooth-jaw system to the multiple general exposure to X-rays. At the same time, such studies could help identify the pathogenetic mechanisms of deep damage to the teeth and periodontium observed in the clinic and experiment under similar conditions, as well as develop and apply more effective treatment and prevention measures [3,4,8].

Research Objective. In this work, we aimed to determine the structural reaction of the nerve elements of the tooth-jaw system to multiple general exposure to X-rays.

Materials and Methods. Experiments were conducted on white rats. The animals were exposed to general X-ray irradiation three times a week at a single dose of 100 r, with total doses reaching 700, 1000, 1500, 2000, and 2500 r. After reaching the required total dose, the animals were sacrificed 5–10 days later. Additionally, materials from several rats that died during the subsequent experimental periods were also used. Jaw bones were fixed in 20% neutral formalin, decalcified in 7% nitric acid or Trilon B, and sections were impregnated according to the Campos and Bilschowsky-Gross methods.

Results. Examination of the experimental material revealed that in rats irradiated with a total dose of 700 r, morphological signs of irritation (razdirazh) of the periodontal nerve elements were detected—swelling of myelinated nerve fibers, increased argentophilia, uneven impregnation, and the appearance of homogeneous or fibrillar varicose dilatations fragmented along the fibers. These changes were most often observed in individual afferent nerve fibers and their preterminal parts, including vascular-tissue receptors, but the majority of periodontal nerve

structures, as well as the fibers in the pulp of incisor and molar teeth, retained their normal structure. Similar changes were observed at a total dose of 1000 r. When the total dose was increased to 1500 r and especially to 2000 r, in addition to signs of irritation of the nerve elements in the experimental animals, signs of more severe damage to the nerve structures were clearly identified. In the bone part of the periodontium, root pericementum, and to a lesser extent in the molars and pulp of incisor teeth, nerve fibers fragmented into pieces of various sizes and shapes, forming vacuoles, were observed. Nevertheless, a portion of the nerve conductors remained unchanged in appearance. In the nerve elements of the incisor tooth pulp, deep destructive signs were not observed in most cases, but in some instances, certain fibers showed varicose dilatation, hyperargentophilia, and even fragmentation into separate pieces.

When the same radiation doses were applied, the degree of expression of neuromorphological changes varied across different animals, depending on the course of the general radiation sickness and the animals' individual radiosensitivity. At total doses of 2500 and 3000 r, when radiation sickness progressed severely, it led to intensification of destructive processes in the tooth and periodontal nerve elements, particularly fragmentation of a portion of the afferent nerve structures. Nevertheless, even at high doses (when the animal's general condition was satisfactory and there were no severe necrosis or other damages in the tooth-jaw system tissues), histological preparations simultaneously showed nerve fibers without structural changes, affected nerve elements, and a small amount of degenerated nerve structures. In animals that died, massive fragmentation of nerve elements was detected both in the tooth pulp and in the periodontium. In the control group, no deviations from the norm were observed at any time points.

Conclusion. Thus, morphological signs of the reaction of the neuroreceptor apparatus of the teeth and periodontium of white rats to multiple general irradiation at single doses of 100 r were detected starting from a total dose of 700 r in the form of irritation of afferent nerve elements. With an increase in the total dose,

destructive processes intensified, leading to fragmentation of nerve structures. Changes in the periodontal neuroreceptor apparatus developed somewhat earlier than in the corresponding structures of the tooth pulp. In this case, damage to the nerve elements in the pulp of incisor teeth was stronger compared to the pulp of molars. Morphological changes in the afferent nerve elements of the tooth-jaw system were observed earlier than structural damages in the tissues they innervate, and subsequently, a correspondence was established between the state of the neuroreceptor apparatus and the general histological changes in the teeth and periodontium. All of this provides the basis for concluding that the damage to the afferent nerve structures we observed plays an important role in the pathogenesis of deep changes in the tooth-jaw system in the form of radiation caries and radiation periodontitis, as described by a number of researchers under the influence of multiple ionizing radiation exposure.

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