MORPHOLOGICAL CHANGES OF BONES IN HYPOPARATHYROIDISM

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Abstract. *Morphological changes in the bone structure, namely the structure of tubular bones against the background of diseases of the parathyroid gland, are insufficiently covered in the literature. Meanwhile, the solution to these issues would contribute to a more in-depth clarification of the place and significance of the hypo parathyroid state of the maternal organism during pregnancy in the pathogenesis of limb deformities from the system into the flesh to generalized forms and would serve as a basis for the development of new pathogenetic prevention and treatment. The purpose of this study was to evaluate changes in the morphological structure of tubular bones of experimental animals with hypoparathyroidism.*

Keywords: *hypoparathyroidism, diseases, organism, morphological changes, structure.*

Relevance. There are quite a lot of various diseases of the musculoskeletal system in children, most often there are deformities of the limbs. The reason for the observed deformities of the development of the bone skeleton during fetal life is due to heredity, infectious diseases of the mother during pregnancy, endocrine pathologies, and toxicosis (especially the first half of pregnancy). Many authors, studying the endocrine status of patients with limb deformities, came to the conclusion that this pathology is hormonal and mainly develops in the late period of the child's intrauterine life.

It has been established that there is a relationship between the function of the parathyroid gland in the mother and the frequency of various forms of orthopedic deformities of the limbs in newborns. A decrease in trace elements in pregnant women caused an increase in the incidence of congenital orthopedic diseases in newborns. Disorders of connective tissue development that occur with hypofunction of the parathyroid gland can also cause skeletal deformities.

Morphological changes in the bone structure, namely the structure of tubular bones against the background of diseases of the parathyroid gland, are insufficiently covered in the literature. Meanwhile, the solution to these issues would contribute to a more in-depth clarification of the place and significance of the hypo parathyroid state of the maternal organism during pregnancy in the pathogenesis of limb deformities from the system into the flesh to generalized forms and would serve as a basis for the development of new pathogenetic prevention and treatment.

The purpose of this study was to evaluate changes in the morphological structure of tubular bones of experimental animals with hypoparathyroidism.

Material and methods.

The experiments were carried out on 28 mature white rats, which were divided into two groups: control (n=12) and experimental (n=16). A group of experimental animals performed coagulation of the 1st lobe of the parathyroid gland and revealed hypoparathyroidism. At the end

of the experiment, the rats were decapitated under light ether anesthesia, tubular bones were extracted and the histological picture of the diaphysis and epiphyses was studied. Bone pieces were fixed in 10% neutral formalin, decalcified for 3 weeks in 7% nitric acid solution with a change of solvent every week.

Thoroughly washed in running water for two days and then passed through alcohols of increasing strength, ethanol-chloroform, paraffin-chloroform, two portions of paraffin, and poured into paraffin. Sections 5-6 microns thick were made and stained with hematoxylin and eosin, picrofuxin, and histochemical staining methods were used: toluidine blue for glycosaminoglycans, CHIC reaction. The study of tissue sections was carried out under a microscope MS-300 (Austria), and microphotography was carried out using a Nikon Cool Pix 4500 camera

Results and discussion.

In animals of the control group, the diaphysis is formed by bone tissue with solid architectonics. The compact (cortical) substance is externally covered with a periosteum consisting of outer and inner layers. The outer layer is formed by dense fibrous tissue, the fibers are oriented parallel to the bone surface. The inner layer is formed by loose fibrous tissue. Fibroblasts and osteoblasts, as well as blood capillaries, are found among the thin collagen fibers. The outer common plate is located under the periosteum, the inner common plate is also deeper defined. On the side of the bone marrow, there is an endost containing osteoblastic cells. The bulk of the compact substance of the diaphysis is made up of osteons, which have the form of cylinders and are located along the long axis of the bone. Insertion (interstitial) plates are located in the spaces between the osteons. Between the bone plates, there are lacunae with osteocytes, the processes of which extend into the bone tubules. Small blood vessels are located in the tubules of the osteons, and perforating channels are also found that provide blood supply from the periosteum.

The trabeculae of the spongy substance of the bone are formed by parallel bone plates combined into packages. There are lacunae with osteocyte bodies with pronounced processes between the bone plates of the spongy substance. Thicker trabeculae located around blood vessels have a similar structure to osteones. Inactive and active osteoblasts are distinguished in bone arches and arches. In the zone of transition of the epiphysis to the diaphysis, the epiphyseal cartilaginous growth plate is determined - hyaline cartilaginous tissue with chondroblasts arranged in the form of cartilaginous columns with signs of calcification of the structure of both the periosteum and the common plates and the osteoid system. Osteones and inset plates are also colored unevenly, there is a tortuosity of the bone plates. Uneven staining and tortuosity of bone plates indicate a violation of the metabolic homeostasis of compact bone, characteristic of the phenomena of destruction and demineralization. In some areas of the common bone plate of the diaphysis, cracks filled with a translucent liquid are revealed. Osteocytes located in bone lacunae are poorly colored and are more characterized by oxyphilicity. Bone lacunae are somewhat larger than osteocytes, and bone plates do not have a clear distinction.

In the spongy substance of the epiphysis of the tubular bone, the anastomosing bone trabeculae differ in a variety of thicknesses and stainability, mainly inactive osteoblasts. There is pronounced branching of bone trabeculae with detachment of the red bone marrow from bone structures. In trabeculae, basophilic wavelike lines are determined, resulting from the processes of demineralization and violation of mineralization of the intercellular substance of bone tissue.

Thus, when hypoparathyroidism is detected in tubular bones, changes in the histological structure of both the diaphysis and meta epiphysis are revealed, characterizing the development of destructive degenerative processes with impaired mineralization of the intercellular matrix.

Based on the results of morphological research methods, the dynamics of the formation of tubular bones are revealed and the regularities of ossification of bone tissue against the background of hypoparathyroidism are established. As a result of the study, the difference from the normal histological picture of hypo parathyroid individuals in the growth zones was shown, namely the basal layer of chondrocytes vacuolized. In places, the appearance of young osteoblasts is determined, they are located according to the type of differently directed architectonics. As a result of a detailed analysis of morphological changes, the dynamics of development in limb deformity against the background of reduced parathyroid function have been prepared. Taking into account the significant influence of mineral metabolism, weight, age, and composition of the diet on the condition of animals, identical conditions were observed during the experiments.

The development of destructive phenomena is most likely associated with the effect of hypoparathyroidism on the state of bone tissue and ultimately leads to a decrease in the metabolism of a number of minerals. Determination of the content of certain elements in the bone tissue of experimental animals, carried out by biochemical blood analysis, showed a significant shift in trace elements, which leads to the destruction of bone tissue, contributing to the development of osteopenia and a decrease in bone strength. Toxic metals can be embedded in the composition of hydroxyapatite crystals, displacing calcium, and also causing metabolic disorders in bone tissue and dysregulation of remodeling processes.

The obtained results of the histological structure of bone tissue reflect a decrease in its strength, observed with a decrease in bone mineral density under the influence of hypothyroidism.

Conclusions.

Our studies show that PTH is necessary for the normal formation of the enchondral bone, mainly additionally regulating individual areas of the growth plate. PTH is produced only in the parathyroid glands, and its synthesis and secretion are regulated by calcium. Thus, the reduced resorption of differentiated chondrocytes is the most likely cause of the slightly enlarged hypertrophic zone observed in rats. PTH indicates an increase in the hypertrophic zone, which leads to a slight increase in the overall size of the growth plate. Therefore, PTH is important for normal cartilage remodeling. In addition, a decrease in osteoblast production in the absence of PTH led to poorly developed primary spongiosis and, ultimately, to a decrease in the volume of spongy bone. However, this reduction led to a decrease in the length of the bone tissue as such, although the total length of the tibia was almost normal. In the tubular growth zone, the ability to maintain normal calcium transport is reduced and, consequently, they develop hypocalcemia. Consequently, the predominant effect on osteoblasts in primary spongioses at this stage of development seems to be associated with PTH.

The hypo-parathyroid state in experimental animals leads to the development of structural changes in the histology of tubular bones. Signs of destructive degenerative processes associated with a violation of the state of the intercellular matrix appear in the diaphysis and meta epiphyses of bones, which undoubtedly leads to a decrease in bone strength.

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