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TO THE QUESTION OF CONNECTIVE TISSUE DISORDERS IN CHILDREN AND ADOLESCENTS WITH ORTHOPEDIC PATHOLOGY

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ABSTRACT — Clinical and histological changes were studied in 96 adolescents with knee pathology of non-traumatic genesis, with signs of connective tissue disease (CTD). The detection of connective tissue dysplasia was carried out according to the data of a clinical examination, functional and radiation diagnostic methods in accordance with the Russian recommendations for algorithms for the diagnosis and treatment of children with connective tissue disease (2015). Serial sections stained with hematoxylin and eosin were examined on an Olympus CX-41 microscope at a magnification of ×100, ×200, ×400. Some of the preparations were additionally stained with picrofuchsin according to van Gieson. Signs of a pronounced diffuse pathological process of a degenerative-dystrophic nature were revealed, caused by hypoxic and metabolic disorders, which led to the development of pain syndrome and became a reason for subsequent surgical intervention.

KEYWORDS — connective tissue disease, morphological changes, collagen fibers, chondrocytes.

INTRODUCTION

The formation of surgical diseases in childhood is based on complex pathogenetic mechanisms associated with mesenchymal disorders. The clinical picture of these disorders often comes to the fore and determines the prognosis of the underlying disease[1, 3].

Modern studies of hereditary, congenital and some acquired diseases of the skeletal system have shown that most of them are based on violations of the molecular structure of a number of organic substances that make up the connective tissue. A systemic defect determines structural and functional disorders at the tissue level, which leads to pathological changes in various organs and systems of the body.

The most common signs of dysmorphogenesis in CTD are changes in the skeleton, muscles and periarticular tissues. For many variants of CTD, a decrease in muscle mass and the size of muscle fibers of striated muscles is characteristic, which indirectly indicates atrophy of muscle tissue. Against the background of developmental anomalies of the lower extremities, systemic skeletal pathology and connective tissue disease, changes in the structures of the knee joint are noted in children and adolescents.

Previous histological studies of bone tissue in children with the syndrome of undifferentiated connective tissue disease revealed the predominance of osteocyticresorption and compensatory replacement of it with fibrous elements [6]. At the same time, local manifestations of lymphocytic infiltration of tendons and perimysiumwere accompanied mainly by osteoclasticresorption with compensatory osteogenesis in the endosteum. A direct dependence of the strength and function of connective tissue on the inflammatory and reparative process in collagen and elastin of tendons, muscles, bones and blood vessels has been established [2, 4].

Damage to the menisci of the knee joint is quite common in comparison with the entire pathology of the knee joint [5]. In the available literature, we did not find data on the relationship between the development of pathological processes in the knee joint in children and adolescents with variants of impaired connective tissue stability. Considering the fact that the number of detected dysplastic changes in the musculoskeletal system in childhood is growing annually in the world, this problem is becoming more and more important.

The aim of the study was to assess morphological changes in the structure of connective tissue in children and adolescents with diseases of the knee joint of non-traumatic genesis.

MATERIAL AND METHODS

Biopsy material obtained intraoperatively during arthroscopy in 96 children and adolescents with phenotypic manifestations of connective tissue dysplasia of varying severity was studied. The selection criterion for the study was the presence of pathological changes in the knee joint in the form of pain syndrome, dam-

age to the meniscus and anterior cruciate ligament of non-traumatic genesis against the background of signs of CTD. There were no syndromic forms of CTD of the type of Marfan, Ehlers-Danlos, etc. in the study group of patients. The severity of CTDmanifestations was assessed according to the classification of T.I. Kadurina and V.N. Gorbunova. The age of children ranged from 11 to 17 years, girls — 51 (53.1%), boys — 45 (46.9%). There were no statistically significant gender and age differences.

Fragments of cartilaginous and fibrous tissue obtained intraoperatively were fixed in 10% buffered formalin solution, followed by histological wiring according to the standard technique and embedded in paraffin blocks. Serial sections stained with hematoxylin and eosin were examined on an Olympus CX-41 microscope at a magnification of ×100, ×200, ×400. Some of the preparations were additionally stained with picrofuchsin according to van Gieson. We studied the morphological structure of the tissue, assessed the presence of hemodynamic disorders, inflammatory infiltration and dystrophic changes, as well as the number of solitary cells and the number of isogenic groups per unit area of unchanged cartilage tissue of the sections studied.

RESEARCH RESULTS

Among the patients, mild severity of CTD was detected in 7 (7.3%) people, moderate severity — in 75 (78.1%), severe — in 14 (14.6%). There were no pronounced connective tissue disorders in patients with mild severity. In patients with severe manifestations of DST, morphological changes on the part of the connective tissue structure were manifested by a sharp thickening of collagen fibers with a chaotic arrangement and a violation of the architectonics of fibrillar structures in the form of pronounced sharp changes in shape and orientation, the appearance of spirally curved and fragmented areas with irregular outlines on transverse sections (Fig. 1).

Microscopy in all observations showed the usual structure of the articular cartilage with a well-visualized outer zone, with single flattened spindle-shaped chondroblasts located in the cartilaginous matrix, and a zone of young cartilage passing without a clear border into the zone of mature cartilage. In the middle and basal zones, chondrocytes were located in isogenic groups in the form of chains of rounded cells oriented perpendicular to the articular surface. In some fields of vision, uneven contours and areas of destruction of the articular surface were revealed, under which the structure of the cartilaginous tissue was distinguished by poorly distinguishable stratification and heterogeneity. Areas of thinning of the surface zone were noted. In the zone of young cartilage, against the background of the predominant intercellular substance, there were areas with a chaotic arrangement of cell nests of chondrocytes, some of which were enclosed in gaps (Fig. 2).

Cartilaginous cells were characterized by an uneven distribution of nuclei with symptoms of karyopycnosis and karyorrhexis. In the deeper layers, there was a proliferation of connective tissue with infiltration with single histiocytes, macrophages and lymphocytes, and a pronounced edema of the intercellular substance with the formation of cracks (Fig. 3). In areas of sclerosis, collagen fibers were colored most intensely. In some observations, against the background of disorganization of collagen fibers of the basic substance of cartilage, among collagen fibers with unevenly expressed tinctorial properties, foci of petrification in the form of polygonal basophilic deposits of calcium salts were noted. The revealed morphological changes are signs of degenerative-dystrophic processes accompanied by an inflammatory reaction.

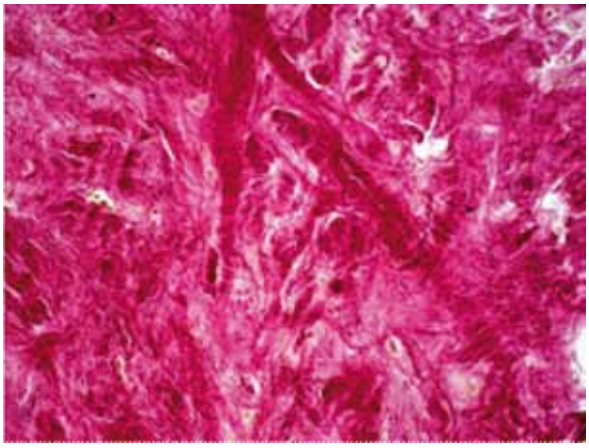

Fig. 1. *Biopsy of the connective tissue of the knee joint.Van Gieson staining with picrofuchsin, ×400. Violation of the architectonics of fibrillar structures*

In normal articular cartilage, the processes of destruction and repair of tissues occur rather slowly, are strictly controlled, are in equilibrium and are the basis of physiological remodeling. Against the background of inflammatory and degenerative-dystrophic processes in the joint, there is a qualitative and quantitative change in the cells and intercellular matrix of the cartilage. The proliferative activity of chondrocytes decreases, the number of cells decreases, the production of proteoglycans practically stops, which entails the loss of water, degradation of the matrix and blocks regeneration.

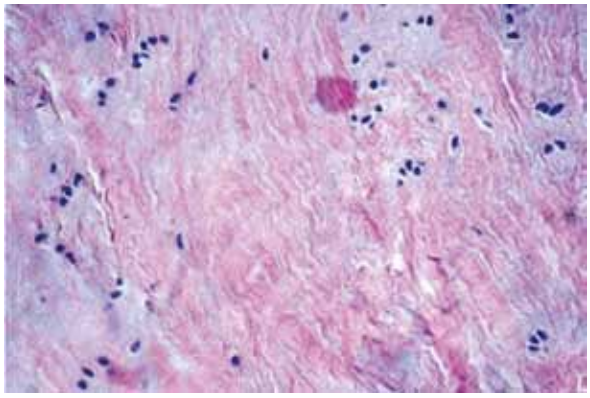

Fig. 2. Fibrous hyaline cartilage. Staining with hematoxylin and eosin, ×200. Chondrocyte nests separated by bundles of collagen fibers. Inhomogeneity of tinctorial properties of the extracellular matrix

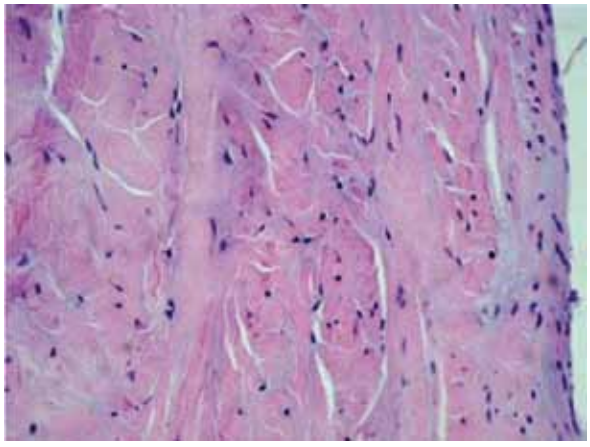

Fig. 3. The synovial tissue of the knee joint. Staining with hematoxylin and eosin, ×200. Edema and inflammatory infiltration of the intermediate substance

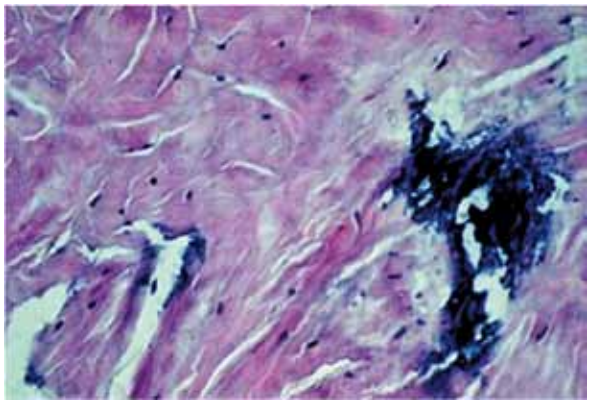

Fig. 4. The synovial tissue of the knee joint. Staining with hematoxylin and eosin, ×200. Petrification in the extracellular matrix

CONCLUSION

The changes in the structure of the connective tissue of the knee joint in children with clinical manifestations of connective tissue disease indicate the presence of a pronounced diffuse pathological process of a degenerative-dystrophic nature caused by hypoxic and metabolic disorders resulting in pain syndrome and a subsequent surgical intervention.

CTD is a polysystemic pathology, which is based on defects in the synthesis and/or catabolism of the components of the extracellular matrix. The use of an integrated approach at the stage of surgical correction, taking into account the severity of CTD, allows not only to reduce the number of postoperative complications and relapses of the disease, but also to outline ways for the further development of approaches in the treatment of this pathology in childhood.

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