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Research Article

DEVELOPMENT THE THORACIC CAGE IN THE EARLY STAGES OF THE POSTNATAL PERIOD THE INFLUENCE OF ANTENATAL DIABETES

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ABSTRACT

The material of the study was 32 mature rats and their offspring. We used informative methods such as histological and histochemical, morphometric. As a result of the study, morphological changes in the bone-cartilaginous-ligamentous structure of the rib-sternal complex in the offspring obtained from pregnant rats with diabetes mellitus in the period of early ontogenesis are presented. It has been established that the negative impact of antenatal diabetes mellitus on the development of the connective tissue formation of the sterno-costal complex. This article describes the morphological changes in the anatomical structures of the rib-sternal complex in rat pups born from pregnant individuals with experimental diabetes mellitus.

KEYWORDS

Cartilage, rib-sternal complex, experimental alloxan diabetes, alloxan, chondrocytes, rats.

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INTRODUCTION

Diabetes mellitus is a global problem, and although it is receiving more and more attention, its importance is growing year by year. The number of patients is growing rapidly. While the total number of people with diabetes in the world has increased fivefold since 1980, in 2018, 422 million people suffered from the disease, accounting for almost 10 percent of the world's population. While maintaining the current situation, the number of cases is projected to double by 2030 and account for 20 percent of the world's total population [WHO 21.10.2021]. Diabetes mellitus is a chronic disease that develops when the pancreas does not produce enough insulin or the body is unable to use the insulin it produces effectively. Insulin is a hormone that regulates blood sugar level [2]. A common consequence of uncontrolled diabetes is hyperglycemia or high blood sugar, which over time can cause serious damage to many body systems, especially nerves and blood vessels. Changes in the shape and functional structure of the chest affects the functional state of the organs in the cavity of the cage [2]. Lack of information on the morphofunctional properties of the rib –thoracic complex leads to serious shortcomings and errors in the prevention and treatment of injuries and deformities in certain areas.

Scientific research in this field is not only scientific but also of practical importance. All of the above allows us to draw conclusions about the problems developed by us and the relevance of the rib-sternal complex due to the prevalence of its deformations and injuries and their morphofunctional substantiation.

The purpose of the work. To study the dynamics of morphological changes in the rib- sternal complex of rats with experimental alloxan diabetes.

MATERIALS AND METHODS

The study was performed on 32 white laboratory rats weighing 150-200 g. The animals were kept in vivariums with food and water according to a standard ration. The animals were divided into two groups for the study. The control group produced 10 rats and the male rats were in a 3: 1 ratio and were injected with 0.5 ml of 0.9% sodium chloride solution once. The study group consisted of 32 rats and the male rat had a 3: 1 ratio. On the fifth day of gestation, experimental diabetes mellitus using an alloxan model was called in rats. A mixture of alloxan 150 mg / kg and distilled water was administered to the experimental group by a single intraperitoneal injection into the abdominal cavity. An increase in blood glucose to approximately 350 mg / dl (Plus Satellite.Russia) confirms hyperglycemia. In our experimental rats, 15 minutes later, the rats were weaned. After 20 minutes, the tails began to turn blue. After 3 hours, thirst and polyuria were observed. The next day there was less convulsions and tachycardia. In a 20- to 24-day follow-up, the study group found that the rats had low mobility, weight loss, long-term wound healing, and hair loss. Of the 22 rats taken for the experiment, 40% died. The study materials were components of the 7-14-21-30-60-day-old thorax of young rats born to mothers with experimental diabetes. The study required histological analysis the rib-sternal complex of the experimental group. The animals were decapitated under general anesthesia using a guillotine knife in accordance with ethical guidelines. For histological examination and incision was made in the rib-sternal complex (IPSUM PATHOLOGY). The samples taken for the experiment were immersed in 10% formalin (Biovitrum). The sample was dried in growing alcohol and histologically processed (STP 120, Thermo Fisher). Then paraffin was poured (Histo Star, Thermo Fisher). The incisions were made in a microtome 4–5 sm thick (HM 325). The prepared pieces were stained with van gizonga,

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hematoxylin eosin and picrofuxin in addition to Masson and Schiff methods to study connective tissue cells and other elements, the drug was prepared and viewed and photographed under a microscope (SARL Zeiss Microscopy GmbH, Axio Lab.A1 Germany).

RESULT AND DISCUSSIONS

The results of the study showed the presence of many SHIK-positive homogeneous structures around the epiphyses and apophyses of the bone as a result of experimental diabetes mellitus of the rib-sternal complex. These changes occur mainly in the extracellular matrix and are characterized by the presence of atrophically altered cells in a group of chondrocytes that shrivel in many forms.

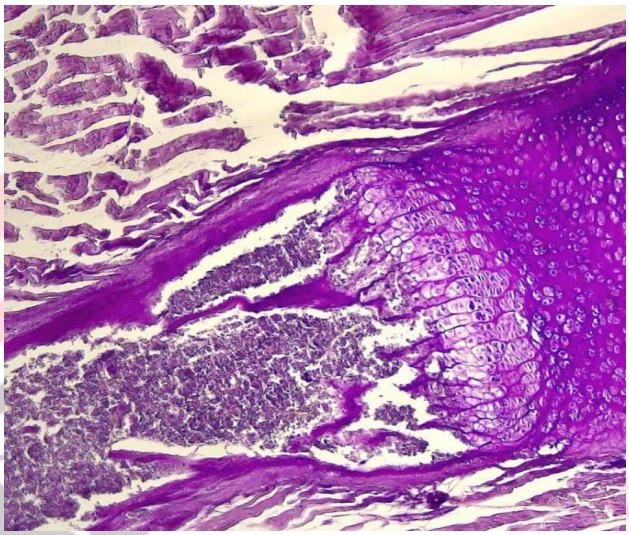

Fig 1. General view of the stern costal joint. The gap between the joints is almost indistinguishable. Most of the interstitial spaces are filled with homogeneous structures. Around the synovial membranes, foci of mucoid edema are detected. The paint is dyed according to Masson. 10x4.

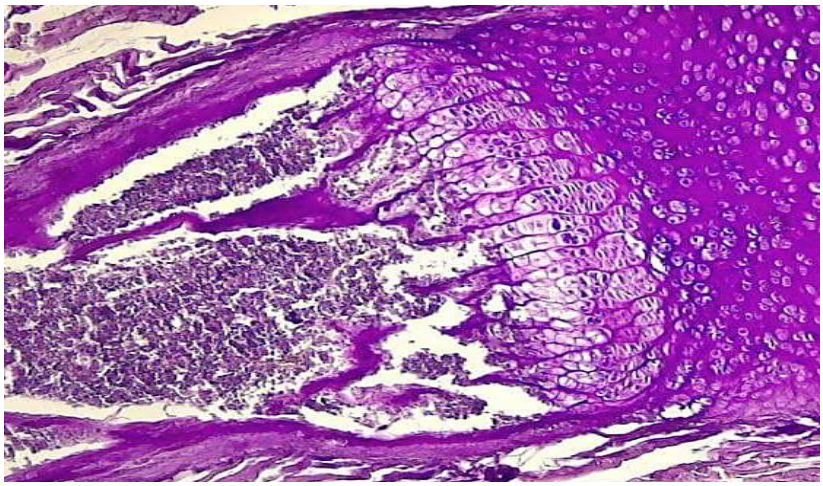

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Fig 2. Proximal part of sternum. Massive dark pink staining of the intermediate in cartilage tissue. In the spectrum of chondrocytes, many glycosaminoglycans are stained dark pink. Chondrocytes come in different sizes. Paint Masson. 10x20.

The accumulation of large amounts of chondroitin sulfate in the intercellular space stains massive pink in the extracellular matrix (see Figure 2), a process that is originally described in the normative form.As a result of experimental diabetes, the diffusion process is disrupted, leading to multiple synthesis of sparse fibrous structures and sclerosis of connective tissue. The formation of dystrophic and metabolic calcinosis foci around sclerosing foci is observed, and the foci of small ossifications develop in the form of ossification points (normally these areas consist of a homogeneously stained glycosaminoglycan substrate, the ossification points develop slowly with age) [3].

The fact that the texture of the chondrocyte nucleus varies in size, uneven and deformed appearance indicates a violation of diffusion nutrition, and in experimental diabetes it is clinically determined that it is accompanied by painful syndromes in this joint. (See Figure 3).

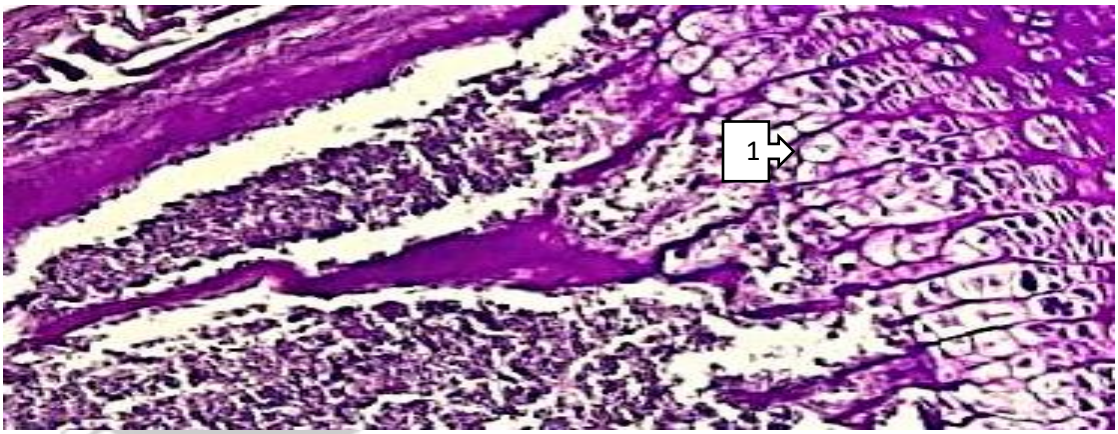

Fig 3. The zone of growth of the epiphysis of the bone is clearly described. The radial chondrocytes in the sequence are of different sizes (1). Paint Masson. Size 10x40.

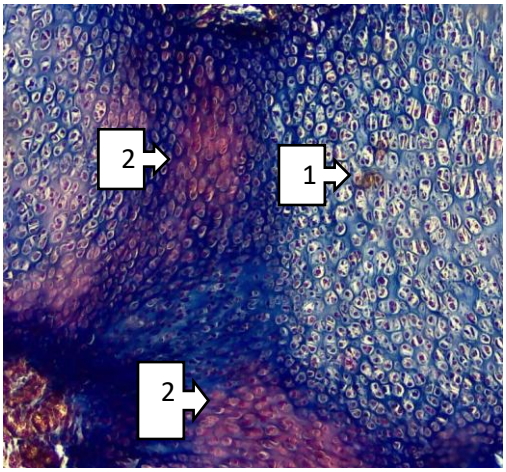

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Fig. 4 The proximal part of the sternum is stained with SHIK. Heterogeneous stained furnaces are detected in susceptible areas (1). In focus, the staining around the chondrocytes is of a different appearance, with the areas rich in glycosaminoglycans being stained from pinkish red to dark red (2). The phenomenon of metachromosis dye SHIK.

10x10.

Fig. 5 Shik positive areas are highlighted in red and SHIK negative areas are highlighted in blue. In pathological areas, focal SHIK negative areas areidentified(1). Paint SHIK 10x20.

To further determine the reliability of these changes, the thoracic rib joint leads to the development of the above changes in the paracapsular areas under the influence of diabetes [4].The assumption that insulin may be a fetal growth factor was primarily derived from human pathology. The large babies of diabetic mothers are thought to be the result of increased insulin concentrations in the fetus, while the products of the opposite hormonal environment are small babies, such as in congenital diabetes mellitus [5, 10].

The mean litter size of the control and the diabetic rats did not differ from each other. Fetal body weights were lower in hyperglycaemic fetuses compared to normal fetuses. The mean weight reduction was 24%. The incorporation of thymidine into fetal rib cartilage was determined. Twenty four hours after the injection of thymidine less radioactivity was found in the rib cartilages of hyperglycaemic fetuses compared to normal fetuses [6].

Conducted histological and histochemical studies allow the analysis of the earliest changes in the tissues of the rib-sternal complex in experimental diabetes [8]. Increased response to mucopolysaccharides in areas of defibration of collagen structures appears to be associated with metabolic disruption of tissue elements in the rib-rib complex in experimental

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diabetes and may lead to the development of deformities in the lower extremities. In rats born with diabetes, the greatest changes occur in the growth zones of the connective tissue, which become significantly thinner and the number of cells in it decreases [7].

Significant changes in mineral metabolism and bone marrow markers in the advanced generation as a result of the adverse effects of experimental diabetes during pregnancy were found to be more pronounced in the late (30-day) follow-up period [9].

CONCLUSION

In conclusion, based on the above histological sections, under the influence of experimental diabetes leads to disruption of the activity of the rib-thoracic complex in the paracapsular areas and the accumulation of pathological metabolites in the extracellular matrix. This process, in turn, requires a reasonable assumption that increased dystrophic necrotic and dysregenerative activity on the surface of large joints leads to the formation of ankylosis in the joints and osteophytes in the apophyses. So, based on the above morphological examinations, the formation of contractures in clinically small and large joints, and the development of practical recommendations that allow to predict the growth of additional osteophytes in ankylosis and apophyses will allow to develop an algorithm to solve another topical problem of evidence-based medicine.

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