GEORGIAN MEDICAL NEWS

ISSN 1512-0112

NO 11 (332) ноябрь 2022

ТБИЛИСИ - NEW YORK

ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

Monthly Georgia-US joint scientific journal published both in electronic and paper formats of the Agency of Medical Information of the Georgian Association of Business Press. Published since 1994. Distributed in NIS, EU and USA.

GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

GEORGIAN MEDICAL NEWS
No 11 (332) 2022

Содержание:

GEORGIAN MEDICAL NEWS
No 11 (332) 2022

STRUCTURAL PECULIARITIES OF ARTICULAR CARTILAGE REACTIVE CHANGES IN RATS WITH AN EXPERIMENTAL UNDIFFERENTIATED DYSPLASIA OF CONNECTIVE TISSUE

Olena A. Hryhorieva[1]*, Yuri Y. Guminskiy[2], Suren D. Varjapetian[1], Vladislav V. Cherniy[1], Pavel V. Bohdanov[1].

[1]Zaporizhzhia State Medical University (Zaporizhzhia, Ukraine), Department of Human Anatomy, Operative Surgery and Topographic Anatomy. Ukraine.

[2]National Pirogov Memorial Medical University (Vinnitsa, Ukraine), Department of Human Anatomy, Ukraine.

Abstract.

In spite of all clinical manifestation of undifferentiated dysplasia of connective tissue (UDCT) including joint hypermobility syndrome still there are no exact morphological characteristics of structural articular cartilage changes on the background of UDCT. The aim: to determine the structural peculiarities of articular cartilage reactive changes in rats with an experimental undifferentiated dysplasia of connective tissue. Study design: animal experience. Methods. The object of the study was 162 knee joints of white laboratory rats, which were divided into 3 groups: - The 1st one – intact animals; the 2nd group consisted of experimental animals, each of which at the 18th day of fetal development was injected by 0.05 ml of antigen in 0.9% NaCl; the 3rd group consisted of control rats, injected by 0.05 ml of 0.9% NaCl at the 18th day of dated pregnancy. Morphological structure of articular cartilage of knee joints was examined at days 1st, 11th, 14th, 21st, 30th, 45th, 60th, 90th, 120th after birth. Fixation of histological material was carried out in 10% neutral formaldehyde. Histochemical, histological methods, statistic methods were used in the work. Results. Experiencing aggressive exposure from osteoblasts of the subchondral bone, along with increasing mechanical stress, the articular cartilage of rats with experimental UDCT, first compensatory turns thicker, and then irreversibly thin down, which is a prerequisite for the development of primary osteoarthrosis. Conclusions. In rats with experimental UDCT the articular cartilage is isolated on the 11th day during the formation of the subchondral bone, in contrast to control rats in which articular cartilage differentiates on the 14th day after birth. In rats with experimental UDCT, the content of sulfated glycosaminoglycans in the matrix of the articular cartilage decreases. There is an accelerated replacement of the deep zone of the articular cartilage by the subchondral bone and the thinning of the articular cartilage on the 90th day after birth.

Key words. Undifferentiated connective tissue dysplasia, cartilage, chondrocytes.

Introduction.

The uniqueness of connective tissue structure and functions creates the conditions for the development of a variety of its anomalies and diseases caused by gene defects having a certain type of inheritance, or due to impairing mutagenic influences of adverse environmental factors in the fetal period (unfavorable environmental conditions, unbalanced nutrition, influence of different antigens, hormonal imbalance, etc.) [1]. Currently, under the term “connective tissue dysplasia” (CTD) it usually understands the anomaly of its structure with a decrease in the content of exact types of collagens or a violation of their ratio, decreasing the strength or quality of connective tissue throughout organs and systems of the organism in general. This results in a homeostasis disorder at tissue, organ and disorders of visceral and locomotor systems [2]. The term ‘undifferentiated connective tissue dysplasia’ (UCTD) is generally used to describe clinical entities characterized by serological evidence of autoimmunity and by the occurrence of clinical symptoms often seen in association with systemic autoimmune diseases (SADs), yet not fulfilling criteria for a specific SAD [3].

In contrast to syndrome forms of connective tissue dysplasia undifferentiated connective tissue dysplasia is not so manifestly and often be ignored [4]. However, the versatility of the connective tissue defect in undifferentiated connective tissue dysplasia involves a variety of visceral changes, and some of them can have serious clinical consequences [5,6]. In the literature there are various synonyms of the undifferentiated connective tissue dysplasia: "mesenchymal dysplasia", "dysfunction of connective tissue", "weak connective tissue", "connective tissue dysplasia syndrome", "unclassified forms of connective tissue dysplasia" [7.].

It is shown that the main reason for the development of undifferentiated connective tissue dysplasia is a violation of the synthesis of fibrous structures and extracellular matrix components of connective tissue, which precede changes on the level of the genome, metabolic proteins, and enzymes, as well as macro - and microelements [8-10]. These factors lead to altered synthesis of collagen and elastin in the cells, to their increased degradation, violation of the structure of elastin and collagen fibers and restructuring of the connective tissue [11]. The main feature of these dysplasias is a wide range of clinical manifestations without a clear clinical picture. Joint disorders (joint hypermobility syndrome) represent one of the most common symptoms of undifferentiated dysplasia of connective tissue [12]. A joint is an organ consisted of articular capsule, articular cartilage, and subchondral bone, that is why, in the case of any pathological condition, including joint hypermobility syndrome, all its components are overwhelmed with reactive changes. In spite of all clinical manifestation of UDCT including joint hypermobility syndrome still there are no exact morphological characteristics of structural articular cartilage changes on the background of UDCT.

The Aim.

To determine the structural peculiarities of articular cartilage reactive changes in rats with an experimental undifferentiated dysplasia of connective tissue.

Methods.

As an experimental model of undifferentiated dysplasia of connective tissue, it is selected a model of intrafetal antigen

injection at the 18th day of dated pregnancy [13-16]. The object of the study was 162 knee joints of white laboratory rats, which were divided into 3 groups: - The 1st one – intact animals; the 2nd group consisted of experimental animals, each of which at the 18th day of fetal development was injected by 0.05 ml of antigen in 0.9% NaCl; the 3rd group consisted of control rats, injected by 0.05 ml of 0.9% NaCl at the 18th day of dated pregnancy. Each group consists of 54 rats (6 rats per each term of investigation). Rats were born full term without developmental malformations and were absolutely healthy. All animals with any symptoms of a disease were avoided to take at experiment. Sex differences were not considered. The formation of a control group of rats is due to the need to eliminate the influence of surgical intervention in the prenatal period on the obtained changes in the experimental group. As the antigen it is selected a human normal immunoglobulin, which has good antigenic properties and very little toxic, pyrogenic and adjuvant effect. Immunoglobulin was administered to fetus in the amount of 0.165 mg of protein in 0.05 ml of saline. Animals were contained in standard conditions of vivarium according to "European Convention for the protection of vertebrate animals used for experimental and other scientific purposes" (Strasbourg, 18.03.86 G.) and the Law of Ukraine № 1759-VI (15.12.2009) On the Protection of Animals from Cruelty. Food and water were made available ad libitum. Morphological structure of articular cartilage of knee joints was examined at days 1st, 11th, 14th, 21st, 30th, 45th, 60th, 90th, 120th after birth. Fixation of histological material was carried out in 10% neutral formaldehyde. Histochemical, histological methods, statistic methods were used in the work. Serial histological sections of 5 μm in thickness after dewaxing were stained with hematoxylin and eosin, alcian blue. Lectin histochemical reaction with Peanut agglutinin (PNA) (Lectin Test, Lviv) was conducted as well (histological sections after dewaxing and dehydration were treated subsequently with 1% methanolic H20 2 for 30 min to block endogenous peroxidase activity; control reactions included omission of the incubation step with the labeled marker to exclude any nonspecific staining by binding of the kit reagents). All samples were embedded in the balm.

Photos of histological samples were conducted using Carl Zeiss software (AxioVision 4.8), digital video camera AxioCam ERc 5s connected to the microscope Axiolab (ZEISS), it allows to view the image of a histological specimen in real time on the monitor screen, select the required area for photographing, obtain a digital image of a histological specimen, save it on the hard disk of a personal computer for further analysis, by applying masks morphometric analysis of chondrocytes was carried out. This method allows to determine the area of cells, the area of nuclei, calculate the nuclear-cytoplasmic ratio, nuclear-cellular ratio. Using the Carl Zeiss software (AxioVision 4.8), the area of chondrocytes was determined in all morpho functional zones of the articular cartilage, the area occupied by the cytoplasm and the nucleus, cells in mitosis were not taken into account. The dynamics of the nuclear-cytoplasmatic ratio in indexes (nucleus area / cytoplasm area) in chondrocytes of the superficial, intermediate, and deep zones of articular cartilage was assessed in 5 fields of view in 5 sections in one animal. The obtained digital images of histological structures are files in JPEG format (without compression) with a color depth (24 bit).

Since the coordinates in the digital image are presented in conventional units - pixels, and for morphological studies it is necessary to operate with real values, a calibration file was used to convert the pixel coordinate system into a real one. This file was created using a millimeter object (GOST 207513-552), photographed in two mutually perpendicular planes. With the help of calibration files, the computer program gives out the sizes of objects in real values (μm). To obtain the parameters of objects, the obtained digital image was processed using Carl Zeiss software (AxioVision 4.8). The relative area occupied by the extracellular matrix and cells was estimated in the programme ImageJ with an overlay of masks. Percentage values were obtained as the ratio of the number of pixels that corresponded to the studied structures that are specifically colored, to the total number of pixels in the digital image of the sample.

Analysis of the obtained results was conducted by means of statistical methods with the use of computer license program «Statistica for Windows 13» (StatSoft Inc., № JPZ804I382130ARCN10-J). The statistical significance of the obtained differences of indicators in the comparison groups was evaluated using the Mann-Whitney U test and considered to be significant at $p < 0.05$, that is generally accepted for biological and medical researches. The numerical data of the obtained results are presented as $M \pm m$ (arithmetic mean ± standard error of the mean).

Ethical approval.

Supporting and withdrawal of animals from experiment was carried out in accordance with the requirements of the European Commission Directive (86/609/EEC), Law of Ukraine № 1759-VI (15.12.2009) On the Protection of Animals from Cruelty.

Results.

The formation of articular cartilage in intact and control newborn rats is not complete. In the distal epiphyseal cartilage of the femur, it defines zones of embryonic epiphyseal cartilage: perichondral, prochondral, metachondral and basal. There is no clear boundary between the zones. In the areas of cartilage facing the patella and tibia, the superficial layers acquire the features of the superficial zone of juvenile articular cartilage with the articular surface beginning to form, the tangential and transitional layer of the superficial zone. In the perichondral zone of the distal epiphyseal cartilage of the femur of intact and control rats, the prevalence of the relative area occupied by cells is determined (Table 1), the density of cell distribution is higher than in the prochondral zone (Table 2). The cells of the perichondral zone are round in shape with a moderate nuclear-cytoplasmic ratio (Table 3). Among the cells of the perichondral zone of both intact and control animals, binucleated cells are determined (11.36%, 11.76% and 13.33%, respectively, in the intact and control groups). The size of cells in the prochondral zone is larger than in the perichondral zone, due to an increase in the area occupied by both the cytoplasm and due to an increase in the size of the nucleus (Table 4). The nuclei are predominantly centrally located. Cells in which the nuclear-cytoplasmic ratio

Table 1. *Dynamics of relative area occupied by the intercellular substance and cells in the morpho-functional zones of the distal epiphyseal cartilage of the femur of newborn rats in norm and experiment (M ± m, %).*

Group of animals	Morpho-functional zones					
	Perichondral		Prochondral		Metachondral	
	cells	Extracellular matrix	cells	Extracellular matrix	cells	Extracellular matrix
1	82,61±1,11	18,15±0,48	51,90±1,18	48,10±1,18	46,07±1,43	53,93±1,43
2	72,20±2,76*	27,80±2,76*	45,80±2,14*	54,20±2,14*	59,20±1,04*	40,80±1,04*
3	82,24±1,04	17,60±1,04	54,17±1,07	45,83±1,07	46,30±1,47	53,70±1,47

*Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

Table 2. *Dynamics of the absolute number of cells (M ± m) per conditional unit area (2500 μm2) of the distal epiphyseal cartilage of the femur of newborn rats in norm and experiment.*

Groups of animals животных	Morpho-functional zones		
	Perichondral	Perichondral	Perichondral
1	29,75±2,68	18,00±2,68	12,86±2,84
2	22,56±1,13*	13,00±1,31*	10,19±1,13
3	30,00±2,21	18,21±1,89	11,88±2,22

*Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

Table 3. *Dynamics of cellular parameters of chondrocytes in the perichondral zone of the distal epiphyseal cartilage of the femur of newborn rats in norm and experiment (M ± m).*

Group of animals	Index				
	Square of the cell, mcm²	Square of nucleus, mcm²	Nucleo-cell ratio	Square of cytoplasm, mcm²	Nucleo-cytoplasmic ratio
1	20,57±0,56	6,67±0,16	0,33±0,008	13,90±0,57	0,51±0,017
2	29,52±0,77*	11,87±0,23*	0,41±0,010*	17,64±0,75*	0,76±0,042
3	20,24±0,50	6,58±0,147	0,33±0,007	13,66±0,34	0,51±0,018

Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.

Table 4. *Dynamics of cellular parameters of prochondral chondrocytes zones of the distal epiphyseal cartilage of the femur of newborn rats in norm and experiment (M ± m).*

Group of animals	Index				
	Square of the cell, mcm²	Square of nucleus, mcm²	Nucleo-cell ratio	Square of cytoplasm, mcm²	Nucleo-cytoplasmic ratio
1	26,73±0,51	9,54±0,24	0,36±0,011	17,19±0,52	0,61±0,029
2	36,12±1,21*	10,83±0,42	0,31±0,011	25,29±0,93*	0,48±0,027**
3	26,12±0,46	9,52±0,199	0,37±0,010	16,60±0,47	0,63±0,026

*Note: 1 - intact rats; 2 - rats after intrafetal administration of immunoglobulin; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

Table 5. *Dynamics of cellular parameters of chondrocytes in the metachondral zone of the distal epiphyseal cartilage of the femur of newborn rats in norm and experiment.*

Group of animals	Index				
	Square of the cell,mcm²	Square of nucleus, mcm²	Nucleo-cell ratio	Square of cytoplasm, mcm²	Nucleo-cytoplasmic ratio
1	39,78±1,38	14,51±0,74	0,36±0,006	25,27±0,64	0,56±0,015
2	49,03±1,36*	11,83±0,37*	0,25±0,011	37,21±0,66*	0,34±0,020
3	38,12±1,26	13,82±0,67	0,35±0,006	24,30±0,59	0,56±0,014

*Note: 1 - intact rats; 2 - rats after intrafetal administration of immunoglobulin; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

is > 1 are identified (12.0% and 10.61%, respectively, in the intact and control groups). In the metachondral zone, there is a slight predominance of the area occupied by the intercellular substance over the area occupied by cells (Table 1). The density of distribution of cells is lower than in the peri- and prochondral zones (Table 2). Among the cells of the metachondral zone, binucleated cells are detected (9.52%, and 12.5% of all cells, respectively, in the intact and control groups). The nuclear-cytoplasmic ratio is moderate (Table 5).

In newborn rats with experimental UDCT the articular cavity is partially formed, there are areas of incomplete resorption between the articular cartilage and the meniscus, the articular cartilage and capsule. The distal epiphyseal cartilage of the femur, as in the control rats, is characterized as an embryonic one with definition of the perichondral, prochondral, metachondral and basal zones. In the perichondral zone, the prevalence of the relative area occupied by cells is determined, but this index is significantly lower than in control group (Table 1). In the prochondral zone, as in the control group, there is a slight displacement towards the intercellular substance (Table 1). The density of distribution of cells in the perichondral and prochondral zones is significantly lower than in the control group (Table 2). Cells of the peri- and prochondral zones are round-shaped. The sizes of cells in all morpho-functional zones are significantly larger than in the control (Tables 3, 4, 5). In the perichondral zone, the relative content of binucleated cells is significantly lower than in the control one (2.86%). In contrast to the control, it defines cells in which the nuclear-cytoplasmic ratio is > 1 (15.71%). In the prochondral zone, on the contrary, in contrast to the control, binucleated cells are determined (12.00%). The relative number of cells with nuclear-cytoplazmic index > 1 is lower than in the control one (4%). In the surface layers of the developing articular cartilage, single dividing cells are found, and single lymphocytes are detected. In the metachondral zone, a slight prevalence of the relative area occupied by cells is determined (Table 1). The density of distribution of cells in the metachondral zone does not significantly differ from the control (Table 2). Cells with a low nuclear-cytoplasmic ratio (93.94%) predominate. The cytoplasm of cells is vacuolated, the nuclei are located eccentrically. Binuclear cells are detected (9.09%). In newborn rats of all groups in the epiphyseal cartilage of the femur and tibia, carbohydrate residues of β-D-galactose in small quantities are determined in the contents of the extracellular matrix. PNA+ receptors are detected in the contents of intracytoplasmic inclusions of cells of the peri-, pro- and metachondral zone, on the cytoplasmic membrane they are practically undetectable.

The 11th day after birth is a key period in the formation of articular cartilage in rats with experimental UDCT: articular cartilage is localized between the surface facing the joint cavity

Table 6. *Dynamics of relative area (M ± m,%) occupied by the intercellular substance and cells in the morpho-functional zones of the articular cartilage of the rats femur in norm and experiment.*

Age, days after birth	Group of animals	Morpho-functional zones					
		superficial		intermediate		basal	
		cells	matrix	cells	matrix	cells	matrix
11-th	1	62,0±3,08	38,0±3,08	48,0±3,08	52,0±3,08	Is not developed	
	2	57,31±2,53	42,69±2,53	49,16±1,91	52,84±1,91	86,14±2,6	13,86±2.6
	3	63,04±1,66	36,96±1,66	46,00±2,60	54,00±2,60	Is not developed	
14-th	1	73,18±2,28	26,82±2,28	56,52±2,75	43,48±2,75	82,50±2,93	17,50±2,93
	2	60,0±2,86*	40,00±2,86*	48,57±2,36*	51,43±2,36*	88,18±1,71*	11,82±1,71*
	3	72,38±2,37	27,62±2,37	56,82±2,86	43,33±2,96	80,00±2,37	20,00±2,37
21-st	1	52,0±3,24	48,0±3,24	45,45±3,99	54,54±3,99	79,09±3,99	20,91±3,99
	2	52,0±3,08	48,00±3,08	51,67±4,67	48,33±4,67	92,50±1,85	7,50±1,85
	3	51,82±1,71	48,18±1,71	46,82±2,29	53,18±2,29	80,00±2,21	20,00±2,21
30-th	1	57,62±3,55	42,38±3,55	57,62±3,55	42,38±3,55	87,00±2,46	13,00±2,46
	2	50,84±2,68	49,16±2,68	49,05±1,78*	50,95±1,78*	90,00±2,16	10,002,16
	3	57,00±3,69	43,00±3,69	58,003,69	42,00±3,69	87,14±2,37	12,862,37
45-th	1	65,63±4,39	34,37±4,39	60,00±3,75	40,00±3,75	92,001,23	8,00±1,23
	2	65,83±3,70	34,17±3,70	69,17±4,62	30,83±4,62	92,73±1,99	7,27±1,99
	3	64,76±3,55	35,24±3,55	60,913,99	39,09±3,99	91,74±1,11	8,261,11
60-th	1	41,88±2,93	58,12±2,93	67,50±2,93	32,5±2,93	83,85±3,46	16,15±3,46
	2	60,00±1,08*	40,00±1,08*	56,962,75*	43,04±2,75*	83,85±1,53	16,151,53
	3	40,95±2,37	59,05±2,37	68,572,37	31,43±2,37	81,43±2,37	18,572,37
90-th	1	44,29±1,78	55,71±1,78	44,292,37	55,71±2,37	69,05±2,37	30,952,37
	2	65,00±3,08*	35,00±3,08*	43,503,08	56,50±3,08	76,36±2,86*	23,642,86*
	3	44,21±2,56	55,79±2,56	44,742,56	53,26±2,56	68,42±2,56	31,582,56
120-th	1	63,75±2,14	36,25±2,14	56,961,66	43,04±1,66	70,00±1,71	30,001,71
	2	57,62±3,55	42,38±3,55	44,292,37*	55,71±2,37*	58,18±2,29*	41,822,29*
	3	63,81±2,37	36,19±2,37	56,671,78	43,33±1,78	69,00±1,85	31,001,85

*Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

and the developing subchondral bone; the articular cartilage is characterized as a juvenile one: the superficial, intermediate and deep zones are clearly differentiated. In intact, control rats, the superficial and intermediate zones of the articular cartilage are clearly differentiated. In the superficial zone, a tangential and transitional layer are distinguished. An accumulation of chondrocytes with vacuolated cytoplasm is determined, equidistant from the surface of the cartilage facing the articular cavity. In rats with experimental UDCT, an increase in the relative area occupied by blood vessels ingrown from the transition zone of articular capsule is revealed (Tables 6-10).

Ingrown blood vessels are surrounded by a rim of PNA+ - matrix, while the extracellular matrix of other cartilage is stained less intensely. Pre-treatment of sections with pepsin reduces the intensity of the distribution of the benzidine label in the extracellular matrix that borders the ingrown blood vessel and indicates the presence of fibronectin. In the wall of the ingrown vessels single PNA + - lymphocytes are determined. In chondrocytes of the superficial zone of articular cartilage, carbohydrate residues of β-D-galactose are determined mainly in the contents of intracytoplasmic inclusions. In rats with experimental UDCT, the relative number of chondrocytes with PNA+ - intracytoplasmic inclusions is higher than in control (Table 11). In the intermediate zone of articular cartilage, PNA receptors are expressed both as part of intracytoplasmic inclusions and on the cytoplasmic membrane of chondrocytes. In the intermediate zone of articular cartilage, the expression of PNA+ - receptors on the cytoplasmic membrane of chondrocytes with vacuolated cytoplasm increases. Uneven PNA + - deposits on the cytoplasmic membrane of non-nuclear chondrocytes are determined. Chondrocytes in which PNA+ compounds are localized both on the cytoplasmic membrane and on intracytoplasmic structures (Table 12). On the cytoplasmic membrane PNA+ - deposits are distributed unevenly, mainly on the surface facing the matrix, but not to the neighboring chondrocyte. PNA- - chondrocytes are found. Rats with experimental UDCT have a significantly higher content of chondrocytes, in which PNA+ receptors are expressed on the cytoplasmic membrane and both on the cytoplasmic membrane and as a part of intracytoplasmic inclusions. In the deep zone of articular cartilage of rats with experimental UDCT, chondrocytes are mostly non-nuclear, PNA+ receptors are localized mainly on the cytoplasmic membrane.

On the 14th day after birth, in the distal epiphyseal cartilage of the femur of intact, control rats, subchondral bone is formed, articular and meta epiphyseal cartilage are differentiated. In the process of morphogenesis of the articular cartilage, chondrocytes of juvenile cartilage are eliminated during the formation of subchondral bone. In the articular cartilage, three morpho functional zones are clearly differentiated: superficial, intermediate, deep. In rats wth experimental UDCT, the articular cartilage is thicker than in the control, a decrease in the content of low- and high-sulfated glycosaminoglycans in the extracellular matrix is determined as compared to intact and control animals (Tables 6, 7, 8, 9, 10, 13).

From the 14th to the 21st day after birth in all groups of rats the extracellular matrix of the transition zone and around the ingrown vessels, the density of the distribution of PNA+ receptors are higher than in the interterritorial matrix of other morpho functional zones of articular cartilage. Pre - treatment of sections with pepsin leads to the elimination of PNA + - structures on the luminal surface of the lining cells. In the superficial zone, PNA+ - compounds are determined mainly in the content of intracytoplasmic inclusions (Table 11), chondrocytes with PNA+ - inclusions and PNA+ - cytoplasmic membrane are less common. In rats with experimental UDCT, a significantly higher number of chondrocytes with PNA+ - intracytoplasmic inclusions is detected compared to the control. Against this background, in this group of rats, the superficial area is significantly thicker than in the control and intact rats, the density of the distribution of chondrocytes on conventional unit of area significantly smaller and the cell size is significantly smaller.

Chondrocytes with different localization of PNA + compounds are found in the intermediate zone (Table 12). There is a predominance of chondrocytes, in which the carbohydrate

Table 7. *Dynamics of the absolute number of cells (M ± m) per conditional unit area (2500 μm2) of the articular cartilage of the rats femur in norm and experiment.*

Age, days after birth	Group of animals	Morpho-functional zones	
		Superficial zone	Intermediate zone
11-th	1	34,06 ± 1,54	4,70 ± 0,22
	2	33,88 ± 2,04	4,24 ± 0,21
	3	34,21 ± 1,61	4,77 ± 0,23
14-th	1	34,03 ± 1,15	4,76 ± 0,21
	2	28,57 ± 1,00*	3,89 ± 0,16*
	3	33,88 ± 1,20	4,71 ± 0,21
21-st	1	26,25 ± 1,15	4,87 ± 0,23
	2	24,40 ± 1,48	4,91 ± 0,22
	3	26,25 ± 0,85	4,85 ± 0,31
30-th	1	25,94 ± 1,15	5,00 ± 0,26
	2	33,44 ± 1,15*	4,33 ± 0,18
	3	25,54 ± 1,04	5,00 ± 0,31
45-th	1	28,13 ± 1,15	4,20 ± 0,15
	2	30,88 ± 1,74	4,25 ± 0,18
	3	28,75 ± 0,97	4,20 ± 0,09
60-th	1	35,00 ± 1,36	4,44 ± 0,27
	2	27,00 ± 1,83*	2,87 ± 0,14*
	3	34,86 ± 1,20	4,42 ± 0,26
90-th	1	16,09 ± 1,66	9,11 ± 1,01
	2	22,97 ± 0,45*	5,12 ± 0,10*
	3	15,71 ± 1,43	9,38 ± 0,97
120-th	1	28,33 ± 1,33	15,42 ± 2,14
	2	30,0 ± 0,67	11,25 ± 0,50
	3	28,50 ± 1,23	16,36 ± 1,71

*Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

Table 8. *Dynamics of cellular parameters of chondrocytes in the superficial zone of articular cartilage of the femur of rats in norm and experiment.*

Age	Group of animals	Index				
		Square of the cell, mcm²	Square of nucleus, mcm²	Nucleo-cell ratio	Square of cytoplasm, mcm²	Nucleo-cytoplasmic ratio
11 -th	1	45,83±1,07	15,35±0,48	0,34±0,01	30,48±0,92	0,54±0,02
	2	40,68±1,01*	17,00±0,54*	0,43±0,01*	23,67±0,92*	0,79±0,03*
	3	46,27±0,99	15,42±0,48	0,34±0,01	30,85±0,92	0,53±0,02
14-th	1	50,46±1,62	17,49±0,56	0,35±0,01	32,96±1,44	0,57±0,03
	2	45,92±0,92*	16,57±0,46	0,36±0,01	29,34±0,64*	0,60±0,02
	3	51,11±1,62	17,62±0,56	0,35±0,01	33,49±1,44	0,56±0,03
21 -st	1	41,00±1,24	14,66±0,66	0,36±0,01	26,34±0,97	0,58±0,02
	2	45,67±1,28*	16,10±0,50	0,36±0,01	29,57±1,03*	0,61±0,03
	3	40,41±1,24	14,42±0,66	0,36±0,01	25,99±0,97	0,58±0,02
30 -th	1	35,67±1,54	12,53±0,58	0,36±0,01	23,14±1,13	0,59±0,04
	2	45,43±1,08*	14,07±0,48	0,32±0,01	31,36±1,13*	0,49±0,02*
	3	36,00±1,03	12,72±0,39	0,36±0,01	23,28±1,13	0,59±0,02
45 -th	1	36,65±1,87	8,82±0,60	0,24±0,01	27,82±1,61	0,34±0,03
	2	49,79±0,12*	11,51±0,46*	0,23±0,01	38,29±1,27*	0,30±0,01
	3	36,66±0,75	9,08±0,24	0,25±0,01	27,59±0,65	0,35±0,01
60 -th	1	43,68±2,86	11,47±0,72	0,27±0,01	32,21±2,53	0,40±0,03
	2	35,97±0,90*	12,05±0,42	0,34±0,01*	23,92±0,80*	0,54±0,02*
	3	42,98±1,43	11,33±0,36	0,27±0,01	31,65±1,90	0,39±0,01
90 -th	1	24,32±1,21	7,41±0,40	0,30±0,01	16,91±0,82	0,45±0,03
	2	38,86±1,56*	9,88±0,50*	0,26±0,01	28,98±1,57*	0,37±0,02
	3	23,87±0,60	7,30±0,20	0,30±0,01	16,58±0,44	0,45±0,03
120 -th	1	44,94±2,16	13,35±0,57	0,31±0,01	31,59±2,09	0,46±0,02
	2	23,09±0,83*	7,80±0,44*	0,34±0,01	15,28±0,55*	0,52±0,02
	3	46,32±1,62	13,70±0,43	0,31±0,01	32,62± 1,57	0,46±0,02

Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.

Table 9. *Dynamics of cellular parameters of chondrocytes in the intermediate zone of articular cartilage of the femur of rats in norm and experiment.*

Age	Group of animals	Index				
		Square of the cell, mcm²	Square of nucleus, mcm²	Nucleo-cell ratio	Square of cytoplasm, mcm²	Nucleo-cytoplasmic ratio
11 -th	1	78,66±2,61	13,83±0,45	0,18±0,01	64,83±2,51	0,23±0,01
	2	126,01±5,23*	15,26±0,94	0,13±0,01	109,21±4,85*	0,15±0,01
	3	78,72±3,29	13,95±0,45	0,18±0,01	64,78±2,28	0,23±0,01
14 -th	1	104,13±3,78	13,30±0,44	0,14±0,01	90,19±3,68	0,17±0,01
	2	175,89±10,20*	17,31±0,75*	0,10±0,01	162,61±6,70*	0,12±0,01
	3	104,49±3,78	13,02±0,66	0,14±0,01	90,42±5,51	0,16±0,01
21 -st	1	126,18±8,61	12,74±1,12	0,11±0,01	114,80±7,43	0,13±0,02
	2	122,81±5,00	12,59±0,18	0,12±0,01	109,57±2,46	0,13±0,01
	3	122,88±8,61	13,17±1,12	0,12±0,01	114,10±7,43	0,14±0,02
30 -th	1	57,04±2,21	16,02±0,60	0,30±0,01	41,02±2,21	0,46±0,03
	2	149,13±11,65*	11,88±0,97	0,09±0,01	146,20±14,65*	0,10±0,01
	3	58,74±2,21	15,93±0,60	0,29±0,01	42,21±2,81	0,42±0,03
45 -th	1	86,74±4,93	12,18±0,56	0,13±0,01	80,15±4,31	0,16±0,01
	2	88,84±5,00	14,23±0,73	0,17±0,01	74,61±4,56	0,21±0,02
	3	87,62±3,28	12,33±0,38	0,14±0,01	80,47±2,87	0,16±0,01
60 -th	1	88,54±6,34	13,30±0,62	0,16±0,01	79,09±5,83	0,19±0,01
	2	80,24±4,66	13,11±0,38	0,19±0,01	67,13±4,47	0,25±0,01
	3	82,76±1,43	12,28±0,31	0,16±0,01	73,03±2,92	0,20±0,01
90-th	1	73,50±2,01	15,55±0,50	0,22±0,01	58,47±1,71	0,28±0,01
	2	71,22±4,06	13,68±0,62	0,22±0,01	57,54±3,88	0,30±0,03
	3	74,27±2,01	15,57±0,50	0,21±0,01	59,31±1,71	0,28±0,01
120 -th	1	72,78±3,03	16,93±0,78	0,24±0,01	55,90±2,91	0,33±0,02
	2	58,84±1,98*	12,12±0,41	0,21±0,01	46,72±1,16*	0,27±0,01
	3	74,52±2,20	17,05±0,52	0,24±0,01	57,47±2,91	0,33±0,02

*Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

Table 10. *Dynamics of cellular parameters of chondrocytes in the deep zone of articular cartilage of the rats femur in the early postnatal period in norm and experiment.*

Age	Group of animals	Index				
		Square of the cell, mcm²	**Square of nucleus, mcm²**	**Nucleo-cell ratio**	**Square of cytoplasm, mcm²**	**Nucleo-cytoplasmic ratio**
11-th	1	Zone is not developed				
	2	466,49±18,59	42,09±2,49	0,10±0,01	434,10±30,70	0,11
	3	Zone is not developed				
14-th	1	364,03±16,94	32,31±2,78	0,08±0,01	389,18±18,76	0,09±0,01
	2	507,12±41,27*	39,61±2,80	0,09±0,01	402,69±18,25	0,11±0,01
	3	358,99±16,97	36,94±5,05	0,08±0,01	392,82±18,76	0,09±0,01
21-st	1	348,64±18,20	95,00±8,85	0,24±0,01	267,66±3,91	0,39±0,04
	2	357,95±19,74	33,57±1,69	0,09±0,01	372,72±24,47	0,09±0,04
	3	340,33±14,56	95,01±8,85	0,24±0,01	335,20±14,56	0,40±0,04
30 -th	1	399,53±20,79	33,24±0,95	0,07±0,01	392,66±22,41	0,08±0,01
	2	410,04±11,14	37,53±2,06	0,08±0,01	399,92±16,08	0,09±0,01
	3	401,60±13,15	31,74±0,92	0,09±0,01	335,69±19,55	0,10±0,01
45 -th	1	182,69±14,04	19,19±2,53	0,10±0,01	173,01±12,41	0,11±0,01
	2	368,49±14,00*	28,80±1,93	0,08±0,01	339,69±13,07	0,09±0,01
	3	181,53±6,30	18,17±2,11	0,09±0,01	174,02±9,31	0,10±0,01
60 -th	1	293,86±12,96	24,41±3,01	0,08±0,01	284,07±18,62	0,08±0,01
	2	266,09±8,02	17,52±0,83	0,07±0,01	243,57±8,06	0,06±0,01
	3	287,33±13,64	23,41±1,84	0,08±0,01	270,15±12,57	0,09±0,01
90 -th	1	163,686±6,06	25,36±5,91	0,148±0,019	149,00±11,23	0,19±0,039
	2	153,07±13,26	17,58±1,29	0,13±0,01	135,42±13,63	0,16±0,02
	3	172,98±9,31	23,92±0,80	0,18±0,011	139,55±7,27	0,28±0,022
120 -th	1	164,09±14,62	17,94±1,57	0,14±0,01	146,15±13,72	0,17±0,03
	2	71,19±5,52*	12,14±1,34*	0,18±0,01	59,05±5,78*	0,23±0,02
	3	161,35±8,75	17,79±0,72	0,14±0,01	143,57±8,93	0,17±0,02

*Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

Table 11. *Dynamics of the relative number of PNA + -chondrocytes of the superficial zone of articular cartilage (M±m, %).*

Type of distribution of PNA⁺-receptors in chondrocytes	**Group of rats**	**Age, day after birth**							
		11	**14**	**21**	**30**	**45**	**60**	**90**	**120**
PNA+ cytoplasmic membrane	1	2,50±0,54	-	-	-	-	0,83±0,54	-	-
	2	-	-	-	-	-	-	-	-
	3	2,61±0,55	-	-	-	-	0,87±0,55	-	-
PNA+ inclusions	1	95,00±1,07	92,73±1,14	96,82±0,57	91,36±1,14	97,50±0,53	94,17±1,07	94,78±1,10	93,70±0,98
	2	98,70±0,55	98,64±0,57*	90,87±1,67*	84,83±1,07*	96,25±1,07	95,83±1,07	96,96±1,10	95,90±1,14
	3	94,78±0,55	92,86±1,18	97,14±0,59	91,90±1,18	97,27±0,57	93,90±1,10	95,00±1,07	93,85±1,01
PNA+ membrane and inclusions	1	2,50±0,54	6,36±1,14	3,18±0,57	8,64±1,14	2,50±0,53	4,17±0,83	2,50±0,54	2,59±0,49
	2	1,30±0,55	1,37±0,57*	9,13±1,67*	12,25±0,54*	2,08±0,54	-	1,67±0,55	1,37±0,57
	3	2,61±0,55	6,19±0,59	2,86±0,59	8,57±0,59	2,73±0,57	4,34±0,55	2,61±0,55	2,31±0,51
PNA+ non nuclear chondrocyte	1	-	0,91±0,57	-	-	-	0,83±0,54	2,50±0,55	3,71±0,98
	2	-	-	-	2,79±0,54	1,67±0,54	4,17±1,07	1,73±0,55	2,73±0,57
	3	-	0,95±0,59	-	-	-	0,87±0,55	2,61±0,54	3,85±0,51

*Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

Table 12. *Dynamics of the relative number of PNA + -chondrocytes of the intermediate zone of articular cartilage (M±m, %).*

Type of distribution of PNA$^+$-receptors in chondrocytes	Group of animals	Age, day after birth							
		11	14	21	30	45	60	90	120
PNA+ cytoplasmic membrane	1	11,60±1,56	8,46±2,02	4,07±0,98	18,18±1,14	12,00±1,04	10,91±1,14	11,67±1,07	12,31±1,01
	2	20,00±1,23*	25,00±3,03*	10,91±1,71*	41,67±2,14*	12,14±0,55	12,61±0,55	11,74±0,55	10,00±0,62
	3	12,17±1,11	8,40±1,04	4,23±0,51	18,10±1,18	12,08±0,54	11,43±0,59	12,17±1,11	12,40±0,52
PNA+ inclusions	1	3,60±0,52	7,60±0,51	45,19±4,41	10,91±1,71	53,20±4,67	8,18±1,14	50,37±1,07	81,53±2,53
	2	5,00±0,62*	2,50±3,03*	12,72±1,14*	-	69,57±2,76*	19,57±2,76*	52,22±1,11	71,60±0,62*
	3	3,33±0,55	7,60±0,52	45,38±2,02	10,95±0,59	55,00±1,61	8,57±0,59	50,00±1,11	82,40±2,07
PNA+ membrane and inclusions	1	54,40±2,60	84,23±2,53	50,37±4,41	70,91±2,29	32,00±4,67	80,91±1,71	36,00±1,61	3,85±1,01
	2	69,00±1,23*	72,50±3,03*	76,36±1,71*	55,92±2,14*	16,52±2,21*	63,48±3,32*	34,82±1,65	17,40±1,23*
	3	55,00±2,14	85,60±2,08	50,00±2,02	71,43±1,18	30,83±1,61	80,00±1,18	36,70±2,22	4,00±0,52
PNA+ non nuclear chondrocyte	1	30,40±3,12	3,46±1,01	-	-	2,8±1,04	-	1,96±0,54	2,31±0,52
	2	6,00±0,62*	-	-	2,42±1,61	1,17±0,55	4,35±0,55	1,22±0,55	-
	3	30,00±2,14	3,60±0,52	-	-	2,92±0,54	-	2,00±0,55	2,40±0,52

*Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

Table 13. *Dynamics of thickness of articular cartilage of the rats femur in norm and experiment.*

Age	Group of animals	Morpho-functional zones			
		Common thickness of articular cartilage, µm	Superficial zone, µm	Intermediate zone, µm	Deep zone, µm
14-th	1	393,40±9,35	36,30±0,55	215,33±8,88	110,74±5,71
	2	619,41±11,41*	54,12±4,46*	396,56±11,71*	168,24±8,57*
	3	397,17±9,95	36,34±0,60	209,78±8,17	106,95±3,41
21-st	1	305,65±15,17	22,9±0,68	183,09±6,23	119,12±3,14
	2	347,42±7,59*	45,44±0,82*	174,59±6,22	127,61±2,75
	3	304,40±14,28	22,42±0,55	183,82±4,82	120,06±3,64
30- th	1	436,67±16,82	40,35±1,62	207,88±11,10	171,36±5,55
	2	425,00±11,99	56,60±4,00*	237,05±4,61	133,33±2,66
	3	455,40±19,21	40,98±1,65	208,88±13,50	171,95±5,91
45- th	1	275,37±13,48	25,43±0,55	115,25±5,91	134,75±6,22
	2	278,93±9,09	49,20±2,46*	111,67±7,67	120,28±5,34
	3	274,25±16,91	26,01±0,68	115,38±8,00	132,38±7,04
60- th	1	136,11±5,62	33,86±1,81	53,13±3,30	65,00±3,61
	2	137,45±9,23	24,49±1,00*	61,00±1,73*	51,20±2,34
	3	139,55±7,27	34,40±2,05	52,00±4,05	66,99±4,67
90- th	1	128,50±1,85	11,10±0,40	52,00±0,80	61,80±1,56
	2	110,32±4,67*	17,32±0,72*	60,05±4,29	29,71±3,16*
	3	128,95±1,92	11,15±0,45	51,60±1,04	60,65±1,66
120-th	1	60,12±1,87	10,96±0,72	32,04±1,08	18,40±0,80
	2	61,77±1,83	9,85±0,40	37,84±1,00*	20,90±1,66
	3	59,61±1,99	10,95±0,82	32,15±1,23	17,56±1,04

*Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

Table 14. *Dynamics of the relative number of PNA + -chondrocytes of the deep zone of articular cartilage (M±m, %).*

Type of distribution of PNA⁺-receptors in chondrocytes	Group of rats	Age, day after birth						
		14	21	30	45	60	90	120
PNA⁺ cytoplasmic membrane	1	15,24±2,36	17,14±1,91	16,67±1,08	1,60±0,52	26,25±3,21	10,43±1,11	-
	2	28,00±1,85*	10,43±1,11*	56,64±2,86*	26,40±2,08*	10,00±1,61*	4,86±0,59*	-
	3	15,50±1,23	17,31±1,53	15,65±1,10	2,08±0,54	26,96±1,65	12,27±1,53	-
PNA⁺ inclusions	1	-	-	-	0,8±0,52	-	6,63±0,55	47,14±2,39
	2	-	-	-	3,60±0,52*	-	10,04±0,59	57,52±1,65*
	3	-	-	-	0,83±0,54	-	6,68±0,51	47,78±1,96
PNA⁺ membrane and inclusions	1	-	45,71±3,83	56,67±2,68	52,40±3,12	2,5±0,53	32,27±2,22	36,43±3,35
	2	29,50±1,85	26,96±2,21*	12,27±1,14*	46,80±2,08	73,00±2,14*	57,83±1,77*	26,96±1,65*
	3	-	46,54±1,53	57,83±1,65	52,50±1,61	2,61±0,55	31,25±1,53	35,19±1,96
PNA⁺ non nuclear chondrocyte	1	81,91±2,36	32,79±3,35	20,00±1,61	42,40±2,60	67,92±3,21	48,71±3,33	16,43±2,39
	2	38,50±2,46*	56,52±1,66*	27,27±2,29*	16,40±1,56*	12,08±1,61*	23,27±1,18*	11,43±0,55*
	3	82,00±1,23	32,54±1,53	19,50±1,65	42,50±1,61	66,96±1,65	46,80±1,53	16,30±0,98

*Note: 1 - intact rats; 2 - rats with experimental UDCT; 3 - control animals in relation to the 2nd group; * - the result of the 2nd group is reliable in comparison with the 3rd group.*

residues of β-D-galactose are part of both intracytoplasmic inclusions and receptors expressed on the cytoplasmic membrane (Table 12). In rats with experimental UDCT, their content is significantly lower than in controls, but it is determined a significantly higher relative number of chondrocytes, in which PNA + receptors are expressed on the cytoplasmic membrane (Table 12). Chondrocytes with vacuolated cytoplasm and nonnuclear chondrocytes with PNA + - cytoplasmic membrane predominate in the deep zone of articular cartilage of all groups of rats. PNA + - deposits are determined mainly on the surface facing the matrix, and not to the neighboring chondrocyte.

On the 30th day after birth in the superficial area of articular cartilage of all groups of rats compared to the 21st day after birth a decrease in number of chondrocytes with PNA + - inclusions is determined against the background of increased detection of chondrocytes with PNA + - intracytoplasmic inclusions and PNA + - cytoplasmic membrane (Table 11). In rats with experimental UDCT, the content of chondrocytes with PNA + - intracytoplasmic inclusions is significantly lower than in controls, and the content of chondrocytes with PNA + - inclusions and cytoplasmic membrane is significantly higher (Table 11). Later on, by the end of the observation period, differences in the ratio of different types of PNA+ - chondrocytes in all groups of animals are almost eliminated. In the deep zone of articular cartilage of intact and control rats, chondrocytes in which carbohydrate residues of β-D-galactose are determined both as part of intracytoplasmic inclusions and as part of cytoplasmic membrane receptors predominate (Table 14). In rats with experimental UDCT, chondrocytes with a PNA+ cytoplasmic membrane predominate. Chondrocytes with PNA+ - intracytoplasmic inclusions in all groups of rats are practically not defined.

Until the fourth month after birth, deep zone chondrocytes are mainly represented by cells characterized by the presence of vacuolated cytoplasm and the predominant absence of a nucleus, with a low nuclear-cytoplasmic ratio (<0.5). On the 120th day, chondrocytes of the deep zone are oval, the cell axis is perpendicular to the articular surface, the nucleus is located somewhat eccentrically, 1-3 nucleoli are determined in the nucleus (Tables 6,7,8,9,10,13). From the 45th up to the 120th day after birth in the intermediate and deep zone of articular cartilage a wave-like change in the ratio of chondrocytes with different localization of PNA+ - compounds is determined, it largely coincides with changes in vacuolation cytoplasm of chondrocytes. On the 120th day after birth on the border of the deep zone of articular cartilage and subchondral bone is found a PNA+ - tide-mark, represented by short ≈ 5-7 μm vertical PNA + - fibers located perpendicular to the articular surface of the bone. Chondrocytes are found directly in the substance of the tide-mark.

The composition and distribution of glycosaminoglycans of the articular cartilage of the distal epiphysis of the femur in rats in the early postnatal period is characterized by zoning and dynamically changes during the first four months of life, which is associated with the ongoing process of chondrogenesis after birth, an increase in the level of motor activity and load on the articular surface. The distribution and composition of glycosaminoglycans of the articular cartilage reflect the degree of its differentiation and the functional activity of chondrocytes in the process of chondrogenesis.

Discussion.

Thus, in newborn animals of all groups, the process of knee joint formation is not complete. The distal epiphyseal cartilage of the femur is characterized as embryonic. In intact, control rats on the 14th day after birth, and in rats with experimental UDCT on the 11th day of life, a secondary focus of ossification - the subchondral bone is formed, it divides the distal epiphyseal cartilage of the femur into articular and meta epiphyseal cartilage. From the moment of formation of the subchondral bone to the fourth month of life, the articular cartilage of all groups of animals is characterized as juvenile, in which three zones are distinguishable: superficial, intermediate, and deep, represented by chondrocytes with vacuolated cytoplasm and pycnotic nucleus. Isogenic groups of chondrocytes are round in shape

and are located mainly radially in relation to the subchondral bone. On the 120th day, after birth, the articular cartilage of all groups of animals is characterized as definitive. The columnar structure of the intermediate zone is well discernible in it. In the deep zone, the tide-mark, the zone of uncalcified and calcified cartilage, are well differentiated. Cartilage, being avascular tissue of considerable size during development, is particularly sensitive even to moderate disturbances of the vascularization process and, consequently, to disorders of nutrition and oxygenation [17]. Therefore, various effects on the fetus, leading to impaired vascularization can cause the development of joint dysplasia.

Earlier it was established that in newborn rats after intranatal antigen administration in a transition zone of articular cartilage the greatest content of lymphocytes in general, and PNA+ lymphocytes in particular were defined [13,16]. PNA+ lymphocytes correspond to the presence of a population of γ/δ-T lymphocytes performing immunoregulatory function among PNA+ lymphocytes [18,19]. The functional activity of PNA+ - lymphocytes causes changes in the functioning, imbalance in the formation of cells of the microenvironment, the synthesis of intercellular substance, fibers of the extracellular matrix, which leads to a violation of the morpho functional state of the organs as a whole [13]. The peak content of PNA+ lymphocytes in the transition zone of the synovial membrane of intact, control and rats after intranatal antigen injection occurs on the 7th day of life. Increased content of PNA+ lymphocytes in the synovial membrane alter the activity of endothelial cells, increasing the synthesis of VEGF, which plays a key role in the process of enchondral ossification [17,20]. It leads to earlier vascular invasion and premature formation of subchondral bone and articular cartilage, the chondrocytes of which are functionally immature, the content of sulfated glycosaminoglycans is lower than the control, these changes properties of articular cartilage. The low content of sulfated glycosaminoglycans in its turn also facilitates the ingrowth of blood vessels from the intermediate zone [21]. According to Moisge N. (1998) under the influence of various factors on the body during fetal development, the expression of carbohydrate residues varies in the composition of various fetal tissues [22]. According to data Y Sassano et al (1992) the presence or absence of the PNA-binding glycoconjugates may be involved in characterizing the nature of the cartilages [23]. Peanut agglutinin (PNA), a lectin with high affinity for galactose-galactosamine disaccharide residues was used for detection of β-galactoside-containing oligosaccharides [24] in the contents of intra- and extracellular substances of cells including galectin – 3, which is found intracellularly in nucleus and cytoplasm or secreted outside the cell and widely spread among different types of cells and tissues including chondrocytes, osteoblasts and osteoclasts, as well as in the endothelial cells from various tissues and organs [25,26]. It participates in different physiological and pathophysiological processes including development, apoptosis, immune reactions etc., [26].

The formation of a secondary focus of ossification is facilitated by an increased in the volume of cell mass, while the level of tissue hypoxia increases [17,27,28]. The cytoplasm of chondrocytes is vacuolated, chondrocytes undergo apoptosis, and molecules of galectin-3, detected by peanut lectin, are expressed on their cytoplasmic membrane. A clear zonation of the distribution of galectin-3 in the chondrocytes of the articular cartilage was observed. In cells of the peri-, pro- and metachondral zone of embryonic epiphyseal cartilage, in the superficial zone of juvenile and mature articular cartilage galectin-3 is a part of intracytoplasmic inclusions of chondrocytes and is not expressed on the cytoplasmic membrane (indicating activity of intracytocytic processes). The relative number of chondrocytes with PNA+ intracytoplasmic inclusions in the superficial zone for four months after birth is quite stable. In addition, the highest relative content of ki-67+ cells in the perichondral zone of the formed articular cartilage are determined in newborn rats with experimental UDCT [29] which is associated with more accelerated rates of differentiation and formation of articular cartilage in rats with experimental UDCT, changing the functional activity of cells in the transition zone.

Conclusions.

Thus, a distinctive feature of the morphogenesis of articular cartilage in rats with experimental UDCT is its isolation on the 11th day during the formation of a secondary focus of ossification - the subchondral bone, in contrast to control rats in which articular cartilage differentiates on the 14th day after birth. This process is accompanied by a pronounced thinning of the articular cartilage during the third week after birth, which is associated with a faster rate of destruction of functionally immature articular cartilage by the subchondral bone with an increase in load due to increased motor activity. In rats with experimental UDCT, the morpho functional activity of chondrocytes of all morpho functional zones of the articular cartilage changes during the first four months of life, which is manifested by a change in the cytological parameters of chondrocytes, a change in the cell-matrix ratio and the density of distribution of chondrocytes, a decrease in the synthesis of sulfated glycosaminoglycans their transport into the extracellular matrix. In rats with experimental UDCT, the content of sulfated glycosaminoglycans in the matrix of the articular cartilage decreases. As a result, there is an accelerated replacement of the deep zone of the articular cartilage by the subchondral bone and, accordingly, the thinning of the articular cartilage on the 90th day after birth. That is, all revealed changes of articular cartilage on the background of experimental dysplasia of connective tissue form the predispositions for earlier development of joint diseases including osteoarthrosis especially in conditions of inadequate physical load on joints.

REFERENCES

1. Osipenko IP. Biochemical markers of undifferentiated connective tissue dysplasia in patients with idiopathic mitral valve prolapse. I.P. Pavlov Russian Medical Biological Herald. 2013;1:38-44.
2. Ben Salha M, Repina NB. Clinical diagnostics of undifferentiated connective tissue dysplasia. I.P. Pavlov Russian Medical Biological Herald. 2016;24:164-172.
3. Antunes M, Scirè CA, Talarico R, et al. Undifferentiated

connective tissue disease: state of the art on clinical practice guidelines. RMD Open 2019;4:e000786.
4. Miheev AV, Trushin SN, Baskevich MA. The phenotypic markers of connective tissue dysplasia in primary spontaneous pneumothorax. I.P. Pavlov Russian Medical Biological Herald. 2013;4:113-116.
5. Castori M, Morlino S, Ghibellini G, et al. Connective tissue, Ehlers-Danlos syndrome(s), and head and cervical pain. Am J Med Genet C Semin Med Genet. 2015;169:84-96.
6. Mosca M, Tani C, Carli L, et al. Undifferentiated CTD: a wide spectrum of autoimmune diseases. Best Pract Res Clin Rheumatol. 2012;26:73-77.
7. Evtushenko SK, Lisovskij EV, Evtushenko OS. Connective tissue dysplasia in neurology and pediatrics. Guidelines for doctors. Doneck: ID «Zaslavskij»; 2009:361.
8. Kadurina TI, Gorbunova VN. Connective tissue dysplasia. Guidelines for doctors. Sankt Peterburg: ELBI; 2009:714.
9. Sung YK, Chung L. Connective tissue disease-associated pulmonary arterial hypertension. Rheum Dis Clin North Am. 2015;41:295-313.
10. Tani C, Carli L, Vagnani S, et al. The diagnosis and classification of mixed connective tissue disease. J Autoimmun. 2014;48-49:46-49.
11. Arroyo-Avila M, Vila LM. Cardiac tamponade in a patient with mixed connective tissue disease. J Clin Rheumatol. 2015;21:42-45.
12. Smirnova TL, Gerasimova LI. Specific clinical features of undifferentiated connective tissue dysplasia syndrome. Doctor Ru. 2018;8:40-44.
13. Hryhorieva OA, Voloshyn MA. Experimental model of undifferentiated dysplasia of connective tissue by impaired antigen homeostasis in the system of mother-placenta-foetus. Pathologia. 2011;8:39-42.
14. Hryhorieva O, Matvieishyna T, Guminskiy Y, et al. General Morphological Characteristics of Gastro-Intestinal Tract of Rats with Experimental Undifferentiated Dysplasia of Connective Tissue. Geo Med News. 2022;6:18-26.
15. Hryhorieva OA, Matveyshina TM, Hrinivetska NV, et al. Intrafetal injection of antigens as an experimental model of undifferentiated dysplasia of connective tissue. Medico-biological aspects and multidisciplinary integration in the concept of human health : proceedings of Ukr. Conf. with int. Participation (Ternopil, 9-11 April 2020.) in III parts/ Ternopil. Nat Med Univ named after I Horbachevsky MPH of Ukraine. – Ternopil : TNMU, 2020:37-40.
16. Voloshyn NA, Grygorieva EA. An experimental model for the development of undifferentiated connective tissue dysplasia syndrome. Pathologia. 2009;6:39-42.
17. Maes C, Stockmans I, Moermans K. Soluble VEGF isoforms are essential for establishing epiphyseal vascularization and regulating chondrocyte development and survival. J Clin Invest. 2004;113:188-199.
18. Behar SM, Porcelli SA. Mechanisms of autoimmune disease induction. The role of the immune response to microbial pathogens. Arthr Rheum. 1995;38:458-476.
19. Hayday A, Tigelaar R. Immunoregulation in the tissues by T cells. Nat Rev Immunol. 2003;3:233-242.
20. Gerber HP. VEGF couples' hypertrophic cartilage remodeling, ossification, and angiogenesis during endochondral bone formation. Nat Med. 1999;5:623-628.
21. Liu Y, Yang H, Otaka K. Effects of vascular endothelial growth factor (VEGF) and chondroitin sulfate A on human monocytic THP-1 cell migration. Colloids Surf B Biointerfaces. 2005;10:216-220.
22. Miosge N, Gotz W, Quandamatteo F. Comparison of lectin binding patterns in malformed and normal human embryos and fetuses. Teratology. 1998;57:85-92.
23. Sasano Y, Mizoguchi I, Kagayama M, et al. Distribution of type I collagen, type II collagen and PNA binding glycoconjugates during chondrogenesis of three distinct embryonic cartilages. Anat Embryol (Berl). 1992;186:205-213.
24. Natchiar SK, Suguna K, Surolia A, et al. Peanut agglutinin, a lectin with an unusual quaternary structure and interesting ligand binding properties, Crystallography Reviews. 2007;13:3-28.
25. Dumic J, Dabelic S, Flögel M. Galectin-3: an open-ended story. Biochim Biophys Acta. 2006;1760:616-635.
26. Sciacchitano S, Lavra L, Morgante A, et al. Galectin-3: One Molecule for an Alphabet of Diseases, from A to Z. Int J Mol Sci. 2018;19:379.
27. Pfander D, Cramer T, Schipani E. HIF-1 controls extracellular matrix synthesis by epiphyseal chondrocytes. J Cell Sci. 2003;116:1819-1826.
28. Schipani E. Hypoxia in cartilage: HIF-1 is essential for chondrocyte growth arrest and survival. Genes Dev. 2001;15:2865-2876.
29. Hryhorieva OA, Pivtorak VI, Popovych YuI, et al. Peculiarities of synoviocytes and chondrocytes proliferative activity in rats with experimental model of undifferentiated dysplasia of connective tissue. World of Medicine and Biology. 2021;2:198-202.

СТРУКТУРНЫЕ ОСОБЕННОСТИ РЕАКТИВНЫХ ИЗМЕНЕНИЙ СУСТАВНОГО ХРЯЩА У КРЫС С ЭКСПЕРИМЕНТАЛЬНОЙ НЕДИФФЕРЕНЦИИРОВАННОЙ ДИСПЛАЗИЕЙ СОЕДИНИТЕЛЬНОЙ ТКАНИ

Григорьева Елена А, Гуминский Юрий Ю, Варжапетян Сурен Д, Черный Владислав В, Богданов Павел В.

Абстракт. Несмотря на все клинические проявления недифференцированной дисплазии соединительной ткани (НДСТ), включая синдром гипермобильности суставов, до сих пор отсутствуют точные морфологические характеристики структурных изменений суставного хряща на фоне НДСТ. Цель: определить структурные особенности реактивных изменений суставного хряща у крыс с экспериментальной НДСТ. Методы. Объектом исследования служили 162 коленных сустава белых лабораторных крыс, которые были разделены на 3 группы: - 1-я - интактные животные; 2-ю группу составили животные, каждому из которых на 18-й день внутриутробного развития вводили по 0,05 мл антигена в 0,9% NaCl; 3-ю группу составили контрольные крысы, которым вводили по 0,05 мл 0,9% NaCl на 18-й день установленной беременности.

Морфологическую структуру суставного хряща коленных суставов исследовали на 1-е, 11-е, 14-е, 21-е, 30-е, 45-е, 60-е, 90-е, 120-е сутки жизни. Фиксацию гистологического материала проводили в 10% нейтральном формальдегиде. В работе использовали гистохимические, гистологические методы, статистические методы. Полученные результаты. Суставной хрящ крыс с экспериментальной НДСТ сначала компенсаторно утолщается, а затем необратимо истончается, что является предпосылкой развития первичного остеоартроза. Выводы. Отличительной особенностью морфогенеза суставного хряща у крыс с экспериментальной НДСТ является его выделение на 11-е сутки при формировании субхондральной кости, в отличие от контрольных крыс, у которых суставной хрящ дифференцируется на 14-е сутки жизни. У крыс с экспериментальной НДСТ снижается содержание сульфатированных гликозаминогликанов в матриксе суставного хряща. Происходит ускоренное замещение глубокой зоны суставного хряща субхондральной костью и истончение суставного хряща на 90-й день после рождения.

Ключевые слова: недифференцированная дисплазия соединительной ткани, хрящ, хондроциты.

სასახსრე ხრტილის რეაქტიული ცვლილებების სტრუქტურული თავისებურებები ვირთხებში შემაერთებელი ქსოვილის ექსპერიმენტული არადიფერენცირებული დისპლაზიით

ოლენა ა. ჰრიჰორიევა[1], იური ი. გუმინსკი[2], სურენ დ. ვარჯაპეტიანი[1], ვლადისლავ ვ. ჩერნი[1], პაველ ვ. ბოჰდანოვი[1]

1ზაპორიჟჟიას სახელმწიფო სამედიცინო უნივერსიტეტი (ზაპორიჟია, უკრაინა), ადამიანის ანატომიის, ოპერაციული ქირურგიისა და ტოპოგრაფიული ანატომიის დეპარტამენტი

2ეროვნული პიროგოვის მემორიალური სამედიცინო უნივერსიტეტი (ვინიცა, უკრაინა), ადამიანის ანატომიის დეპარტამენტი

ბსტრაქტული

შემაერთებელი ქსოვილის არადიფერენცირებული დისპლაზიის (UDCT) ყველა კლინიკური გამოვლინების მიუხედავად, სახსრის ჰიპერმობილობის სინდრომის ჩათვლით, არ არსებობს სახსრის ხრტილის სტრუქტურული ცვლილებების ზუსტი მორფოლოგიური მახასიათებლები UDCT-ის ფონზე. მიზანი: შემაერთებელი ქსოვილის ექსპერიმენტული არადიფერენცირებული დისპლაზიის მქონე ვირთხებში სასახსრე ხრტილის რეაქტიული ცვლილებების სტრუქტურული თავისებურებების დადგენა. კვლევის დიზაინი: ცხოველთა გამოცდილება. მეთოდები. კვლევის ობიექტი იყო თეთრი ლაბორატორიული ვირთხების 162 მუხლის სახსარი, რომლებიც დაიყო 3 ჯგუფად: - პირველი - ხელუხლებელი ცხოველები; მე-2 ჯგუფი შედგებოდა ექსპერიმენტული ცხოველებისგან, რომელთაგან თითოეულს ნაყოფის განვითარების მე-18 დღეს შეჰყავდათ 0,05 მლ ანტიგენი 0,9% NaCl-ში; მე-3 ჯგუფი შედგებოდა საკონტროლო ვირთხებისგან, რომლებსაც გაუკეთეს 0.05 მლ 0.9% NaCl დათარიღებული ორსულობის მე-18 დღეს. მუხლის სახსრების სასახსრე ხრტილის მორფოლოგიური სტრუქტურა გამოკვლეული იყო დაბადებიდან 1-ლი, მე-11, მე-14, 21-ე, 30-ე, 45-ე, 60-ე, 90-ე, 120-ე დღეებში. ჰისტოლოგიური მასალის ფიქსაცია ჩატარდა 10% ნეიტრალურ ფორმალდეჰიდში. ნაშრომში გამოყენებული იყო ჰისტოქიმიური, ჰისტოლოგიური მეთოდები, სტატისტიკური მეთოდები. შედეგები. სუბქონდრალური ძვლის ოსტეობლასტების აგრესიული ზემოქმედების დროს, მექანიკურ სტრესთან ერთად, ვირთხების სასახსრე ხრტილი ექსპერიმენტული UDCT-ით, რომელიც არსებითად ფუნქციურად მოუმწიფებელია, ჯერ კომპენსატორულად ხდება სქელი, შემდეგ კი შეუქცევადად თხელდება, რაც პირველადი განვითარების წინაპირობაა. ოსტეოართროზი. დასკვნები.ექსპერიმენტული UDCT-ით ვირთხებში სასახსრე ხრტილის მორფოგენეზის გამორჩეული თვისებაა მისი იზოლაცია მე-11 დღეს ოსიფიკაციის მეორადი ფოკუსის - სუბქონდრალური ძვლის ფორმირებისას, საკონტროლო ვირთხებისგან განსხვავებით, რომლებშიც სასახსრე ხრტილი დიფერენცირებულია მე-14 დღეს. დაბადების. ვირთაგვებში ექსპერიმენტული UDCT-ით, სულფატირებული გლიკოზამინოგლიკანების შემცველობა სასახსრე ხრტილის მატრიქსში მცირდება. შედეგად ხდება სასახსრე ხრტილის ღრმა ზონის დაჩქარებული ჩანაცვლება სუბქონდრალური ძვლით და, შესაბამისად, სასახსრე ხრტილის გათხელება დაბადებიდან 90-ე დღეს.

საკვანძო სიტყვები: არადიფერენცირებული შემაერთებელი ქსოვილის დისპლაზია, ხრტილი, ქონდროციტები