

In patients with acute pyoderma, regardless of the depth of the pathological process, there were a biinfection of lesions with obligatory presence in the microbial associations of *S. aureus* with the incidence of participation in them of «other microorganisms» (*Micrococcus*, *Bacillus*, *Sarcina*, *Acinetobacter*) and the emergence of *E. coli*.

Chronic pyodermas, both superficial and deep, are characterized by more branching of microbial compositions and the growth of the specific gravity of *E. coli* and other microorganisms. In addition, the pustular skin diseases, regardless of the clinical course, is characterized by excessive growth of *S. aureus*, *Str. pyogenes*, *S. epidermidis*, *S. saprophyticus*, *E. coli* and «other microorganisms».

Conclusion. The microbiota of skin in patients with pyoderma is difference. This aspect caused of individual management of pyoderma.

Key words: pyoderma, diagnosis, skin microorganisms.

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THE INFLUENCE OF NANOCRYSTALLINE CERIUM DIOXIDE ON PHYSICAL AND CHEMICAL PROPERTIES OF RAT SKIN

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Introduction. Damage or disruption of the normal anatomical structure and function of the tissues is determined by the wound process [1-4], which may range from a simple rupture of the epithelial integrity of the skin to a deeper penetrating subcutaneous tissue, characterized by damage to other structures such as tendons, muscles, vessels, nerves, parenchymal organs or bones.

The first publications about the use of composites of cerium in composition of medicinal facilities appeared in 50th of XIX century [5]. For the last 20 years the amount of the experimental works devoted to nanocrystalline cerium dioxide (NCD) increased in 100 times, that testifies to the increase of attention of researchers to this drug. Unique biochemical properties of NCD are discovered in recent years, due to that it is able to execute the functions of some enzymes, - oxidoreductase, phosphatase and others like that [6,7]. The hypotoxicity of NCD provides the relative healthy application in vivo, that allows to examine it as potential medical preparation for therapy of series of pathologies as well as wound healing.

In most cases, the water-soluble salts of cerium (III) (nitrate, chloride, sulfate and acetate), as well as insoluble compounds (stearate and cerium oxalate), including in the form of colloidal solutions, act as an active ingredient [8,9]. In the literature it is noted that the biological activity of cerium salts in some cases may be due to the proximity of the ion radii Ce^{3+} and Ca^{2+} , and therefore cerium ions are capable of partially replacing calcium ions in a number of biomolecules [10]. It has been shown that NCD, due to its physical and chemical properties, is able to protect the cell from the action of various factors (such as oxidizes) that cause oxidative stress. Cerium dioxide nanoparticles are able to partici-

pate in the regulation of the ROS as an acceptor of free radicals both in vitro and in vivo, due to the ability to oxygenate non-stoichiometry [11].

However, the literature data on the structure and properties of NCD contain contradictions it must be noted that numerous properties and effects on living organisms of this composite have not been studied at this time, which opens the prospects for further research.

Modern wound treatment is impossible without deep knowledge of the wound process, since any influence on the latter should be pathogenetically grounded, taking into account the phases and periods of the wound process, as well as the morphological, biophysical, biochemical and molecular processes that can occur in the tissues. Therefore, in order to stimulate wound healing, it is advisable to use such medications that would simulate the properties of the intercellular substance of the connective tissue and would correspond to the pathogenesis of the wound process. For the treatment of wounds we used NCD gel and obtained positive effects.

The aim of the study. The aim of the study was to investigate the effect of NCD on the physical and chemical properties of skin.

The object and methods of investigations. Research was conducted on 40 white laboratory male rats weighing 200–250 g, which were divided into four groups. Keeping animals and experiments were conducted according to ethical principles adopted by Ukraine First National Congress on Bioethics, international agreements and national legislation in this area [12]. Before the experiment, the rats were retained in quarantine and were marked by given them notches on ears. The animals of 1st group were control (intact without wounds). In animals of 2nd, 3rd and 4th groups full-thickness wounds of 1x1 cm² were formed in the skin of each rat using surgical scalpel and forceps [13]. In rats of 2nd group wound healing happened without use any drugs. In rats of 3rd group full-thickness wounds were treated by Carbopol gel (0,5 % Carbopol solution based on saline solution) once daily until healing. In rats of 4th group full-thickness wounds were treated by 0,05% NCD gel (NCD was dissolved in 0,5% Carbopol gel) once daily until healing. Before performing the full-thickness

wound model, animals were anesthetized by sodium thiopental (Biochemie GmbH/Austria), at a dosage of 50 mg/kg.

To determine the percentage of moisture in the tissue, skin samples were weighed on analytical scales and dried to constant weight at 80° C in a drying cabinet SNOL 3,5.3.5.3.5. / I1 (Russia). In studying the functional properties of the connective tissue, the output of collagen gelatin was investigated by hydrothermal welding of the skin [14]. The temperature of the skin was measured using the device PTC-1 (USSR). A piece of skin was fixed with the hooks of the apparatus, poured water and slowly heated. Under the influence of the thermal factor, the skin began to decrease linearly, which led to the tension of the cord and the commissioning of the timer indicator. The temperature of the welding was determined by the mercury thermometer and it corresponded to the beginning of the movement of the indicator arrow. To study the collagen content we used the Kjeldahl method [14,15].

Statistical analysis of data was carried out by the "Statistica 8.0" software package. Shapiro-Wilk's W criterion was used for the investigation of the data distribution type. Posthoc analysis included Student's t-test for parametric data.

Results and discussion. It was established that moisture content in the skin of animals of control group (without wounds) was 60,3±5,6% (table). In the skin of animals after healing of untreated wounds moisture content decreased by 39,8% (p<0,01). Wound treatment with Carbopol gel or NCD gel did not affect moisture content in the skin after healing compared to the animals with untreated wounds.

Collagen content in the skin of animals of control group was 35,8±3,3% (table). In the skin of animals after healing of untreated wounds collagen content increased by 59,8% (p<0,05) in comparison with the animals of control group that confirms the formation of a scar in the place of the former full-thickness skin wound. Wound treatment with Carbopol gel didn't affect on collagen content compared to the animals with untreated wounds. The use of NCD gel in the treatment of the skin wound has led to a decrease in collagen content to the level of control animals without wounds. These findings confirm the our findings of wound healing by the action of NCD gel without the formation of a rough scar at the site of the full-thickness skin wound.

Smelted gelatin content in the skin of animals of control group was 2,1±0,2% (table). In the skin of animals after healing of untreated wounds smelted gelatin content increased by 95,2% (p<0,001). Wound treatment with Carbopol gel didn't influence on smelted gelatin content compared to the animals with untreated wounds. But wound treatment with NCD gel has led to diminishing of smelted gelatin content to the level of control animals without wounds.

Temperature of welding of a skin in animals of the control group was 60,3±5,6° C (table). In rats after healing of untreated skin wounds temperature of welding of

Table.

The moisture content, collagen content, smelted gelatin content and the temperature of the welding in the skin of animals after healing of the full- thickness wounds, (M ± m, n=10)

Animal group	Moisture content, %	Collagen content, %	Smelted gelatin content, %	Temperature of welding of a skin, °C
Control (without wounds (I group))	60,3±5,6	35,8±3,3	2,1±0,2	60,3±5,6
Wounds (untreated (II group))	36,3±3,4**	57,2±5,3*	4,1±0,4***	85,1±7,9*
Carbopol+wound (III group)	35,1 ±3,3**	47,2±4,4*	3,2±0,3*	79,1±7,3*
Wound+ Nanoceria-Gel (IV group)	40,4±3,7*	39,1±3,6#	2,6±0,2##	65,5±6,1#

Note. * - p<0,05, ** - p<0,01, *** - p<0,001 compared to the control (1st group); # - p<0,05, ## - p<0,01 compared to the animals with untreated wounds.

a skin increased by 41,1% (p<0,05). In the skin of animals after wound treatment with Carbopol gel temperature of welding of a skin didn't change in comparison with animals rats after healing of untreated skin wounds. Wound treatment with NCD gel has led to decrease of temperature of welding of a skin to the level of control animals without wounds.

The changes in the properties of skin after healing of untreated wounds are associated with a decrease in the fluid content in the extracellular component of the connective tissue, which ultimately leads to the destruction of the structure of collagen fibers [16]. Our results coincide with the data of Mavrov [17], which showed a decrease in the moisture content, an increase in collagen content and the temperature of the welds in the skin, indicating metabolic disturbances in chronic dermatosis. The characteristic changes are related to the fact that when injuring the skin during the wound healing begins with acute inflammatory phase and ends with the formation of a scar. When scarring, collagen is accumulated in response to tissue damage. The formation of a scar, ultimately, is the result of excessive accumulation of extracellular matrix (EM).

Although remodeling of the scars occurs within months or years after the initial injury, complete restoration of normal EM architecture is never achieved. Thus, healing of wounds is a fibroproliferative response, which leads to incomplete regeneration of the affected tissue and excessive production of the mesh collagen structure - scar tissue. With the use of new NCD gel healing, there was no coarse scar tissue that was confirmed by our research (the percentage of collagen in the skin was less than that of untreated animals).

Previously it was shown that in the skin of young people the content of moisture and collagen remained within the normal range, patients in middle age the moisture content decreased, and the percentage of collagen remained unchanged. The moisture and collagen content of the skin of the elderly significantly decreased [16]. Thus, injury to the skin is accompanied by a decrease in moisture content, an increase in collagen content and its welding temperature, and an increase in the content of the smelted gelatin. Reducing moisture in the dermis leads to a decrease in the hydration of collagen fibers and their degradation as a consequence - pathological changes in the skin, indicating metabolic disturbances. Thus, in the treatment of skin wounds, NCD gel

is effective, it exhibits wound healing, anti-inflammatory action and antioxidant properties, which results in wound healing without rough scarring, as evidenced by a lower percentage of collagen content in the skin of treated animals compared with untreated ones.

Conclusions. The experimental cut of the wound in the skin reduces the moisture content of the dermis, which leads to a decrease in the hydration of collagen fibers and their destruction, increases collagen content, welding temperature, increases the content of smelted gelatin, characterizes pathological changes in the skin. In the case of the use of NDC, all of the above indicators

returned to normal: the moisture content increased, the content of collagen did not differ from the control, because there was no scar tissue, the gelatin output decreased in the cut wound, the temperature of the weld of the skin in the cutaneous wound decreased. That testifies to the efficiency of NDC for the treatment of wounds of skin of different genesis.

Prospects for further development. In order to create a new dermatotropic drug, further studies will be aimed at the continuation of preclinical studies of NDC: chronic toxicity and pharmacokinetics.

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ВПЛИВ НАНОКРИСТАЛІЧНОГО ДІОКСИДУ ЦЕРІЮ НА ФІЗИКО-ХІМІЧНІ ВЛАСТИВОСТІ ШКІРИ У ЩУРІВ АРЕФЕХ АМІРІ, РАДЗИМІНСЬКА О. В., ВЕРЕЩАКА В. В., СТЕПАНОВА Л. І., БЕРЕГОВА Т. В.

Резюме. На білих нелінійних щурах самцях вивчали вплив розробленого нами гелю нанокристалічного діоксиду церію (НДЦ) (0,05% НДЦ, розчиненого в 0,5% гелі карбополу) на фізико-хімічні властивості шкіри. Після гоєння необроблених ран в шкірі зменшувався вміст вологи, зростали вміст колагену, виплавленої желатини, температура зварювання. Лікування ран гелем карбополу або НДЦ не впливало на вміст вологи в ділянці бувшої рани, всі інші показники лише під дією НДЦ відновлювалися до рівня контролю.

Ключові слова: нанокристалічний діоксид церію, вирізані повношарові рани, вологість шкіри, колаген, виплавлена желатина.

ВЛИЯНИЕ НАНОКРИСТАЛЛИЧЕСКОГО ДИОКСИДА ЦЕРИЯ НА ФИЗИКО-ХИМИЧЕСКИЕ СВОЙСТВА КОЖИ У КРЫС

АРЕФЕХ АМИРИ, РАДЗИМИНСКАЯ О. В., ВЕРЕЩАКА В. В., СТЕПАНОВА Л. И., БЕРЕГОВАЯ Т. В.

Резюме. На белых нелинейных крысах самцах изучали влияние разработанного нами геля нанокристаллического диоксида церия (НДЦ) (0,05% НДЦ, растворенного в 0,5% геле карбопола) на физико-химические свойства кожи. После заживления необработанных ран содержание влаги в коже уменьшалось и возрастали содержание коллагена, выплавленной желатини, температура сварки. Лечение ран гелем карбопола или гелем НДЦ не влияло на содержание влаги в участке бывшей раны, все другие показатели под действием НДЦ восстанавливались до уровня контроля.

Ключевые слова: нанокристаллический диоксид церия, вырезанные полношаровые раны, влажность кожи, коллаген, выплавленная желатина.

THE INFLUENCE OF NANOCRYSTALLINE CERIUM DIOXIDE ON PHYSICAL AND CHEMICAL PROPERTIES OF RAT SKIN

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Abstract. Formerly we established that treatment of the full-thickness wounds by nanocrystalline cerium dioxide gel (NCD) dissolved in Carbapol gel accelerates complete wound closure and reduced wound area in comparison with non-treated animals. Also it was shown that wound healing was without formation keloid scar. Further research is needed to create a new dermatotropic drug.

The aim of the study was to investigate the effect of NCD gel on the physical and chemical properties of skin after healing of the full-thickness wound.

Research was done on 40 white laboratory male rats weighing 200–250 g, which were divided into three groups. Before performing the full-thickness wound model, animals were anesthetized by sodium thiopental at the dose of 50 mg/kg. The animals of 1st group were control (intact without wounds). In rats of 2nd, 3rd and 4th groups full-thickness wounds of 1x1 cm² were formed in the skin. In rats of 2nd group wound healing happened without use any drugs. In rats of 3rd group full-thickness wounds were treated by Carbopol gel (0,5 % Carbopol solution based on saline solution) once daily until healing. In rats of 4th group full-thickness wounds were treated by 0,05% NCD gel (CeO₂ was dissolved in 0,5% Carbopol gel) once daily until healing.

To determine the percentage of moisture in the tissue, skin samples were weighed on analytical scales and dried to constant weight at 80 ° C in a drying cabinet SNOL 3,5.3.5.3.5. / 11. In the study of functional properties of connective tissue, the output of collagen gelatin was determined by hydrothermal welding of the skin. The skin welding temperature was measured using the device PTC-1. A piece of skin was fixed with the hooks of the apparatus, poured water and slowly heated. Under the influence of the thermal factor, the skin began to decrease linearly, which led to the tension of the cord and the commissioning of the timer indicator. The skin welding temperature was determined by the mercury thermometer and it corresponded to the beginning of the movement of the indicator arrow. To study the collagen content we used the Kjeldahl method.

Statistical analysis of data was carried out by the "Statistica 8.0" software package. Shapiro-Wilk's W criterion was used for the investigation of the data distribution type. Posthoc analysis included Student's t-test for parametric data.

In the skin of animals after healing of untreated wounds moisture content decreased by 39,8% (p<0,01) but collagen content increased by 59,8% (p<0,05), smelted gelatin content increased by 95,2% (p<0,001), temperature of welding of a skin increased by 41,1% (p<0,05) in comparison with control. Wound treatment with Carbopol gel did not affect moisture content, collagen content, smelted gelatin content, temperature of welding of a skin after healing compared to the animals with untreated wounds. Wound treatment with NCD gel did not affect moisture content in the skin after healing compared to the animals with untreated wounds but collagen content, smelted gelatin content and temperature of welding of a skin they recovered to the level of control (skin of control intact animals without wounds).

We consider NCD gel as a new promising dermatotropic drug in the form of a soft bandage.

Key words: nanocrystalline cerium dioxide, full-thickness wound, collagen, moisture, smelted gelatin.

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НЕКОТОРЫЕ ИТОГИ И ПЕРСПЕКТИВЫ ИЗУЧЕНИЯ HELICOBACTER PYLORI-ИНФЕКЦИИ

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Связь публикации с плановыми научно-исследовательскими работами. Данная работа является фрагментом выполняемой диссертации на соискание ученой степени доктора философии по медицине «Оптимизация лечебно-профилактических мер и диспансеризации при Хеликобактериозе».

Вступление. Несмотря на значительный прогресс в методах диагностики и лечения заболеваний органов пищеварения, до настоящего времени не удалось добиться снижения частоты гастроэнтерологических заболеваний, рост которых обуславливается воздействием неблагоприятных факторов окружающей среды, снижением уровня жизни населения во многих странах, нарастанием частоты встречаемости стрессовых ситуаций, особенно в младших возрастных группах, которые являются наиболее уязвимы-

ми группами или группами повышенного риска [1,2]. Основная роль в этиологии и патогенезе изучаемых патологий принадлежит инфекции Helicobacter pylori, представляющей собой сложную проблему в связи с вирулентностью, высокой изменчивостью возбудителя и частым формированием резистентности к лекарственным препаратам [3,4]. Низкая эффективность диагностических и лечебных мероприятий, в частности, эрадикация H. pylori, при возникновении заболевания способствует дальнейшему развитию патологического процесса с возрастом, тогда как, при внедрении оптимальных методов лечения значительно снижает в дальнейшем риск возникновения возможных и очень серьезных осложнений, вплоть до рака желудка [5,6]. Ведущая роль в этиологии и патогенезе хронических заболеваний