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## PATHOHISTOLOGICAL STUDY OF RAT SKIN AT CHEMICAL BURN WITH ACETIC ACID

**Resume.** The study of chemical burns in animals is a serious problem in surgery. Burns, even superficial, and all the more deep, quickly become life-threatening for the animal, since, in addition to local changes, they cause general disturbances in the body by the occurrence of burn toxemia, as well as the reproduction of pathogenic microflora on the surface of burn wounds. The article shows a comprehensive histological study of rat skin cells with a chemical burn with acetic acid against the background of the use of dressings with a carbon sorbent, which have antimicrobial action due to carbon fiber, actively removing pathological microflora from the wound for 7 and 14 days. It was found that the use against the background of the use of dressings with a carbon sorbent for 7 and 14 days with a chemical burn with acetic acid leads to a decrease in pathological processes and to an increase in the general antioxidant activity in the skin of rats. The data obtained allow us to speak about the use of carbon sorbent dressings, which have the ability to absorb wound secretions, while exerting a pronounced sorption effect in relation to microorganisms, provides a positive effect on the rate of healing of a burn injury, and improves the general condition of the body.  
**Key words:** burn, medical dressing, acetic acid, skin.

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### СІРКЕ ҚЫШҚЫЛЫМЕН ХИМИЯЛЫҚ КҮЙІК КЕЗІНДЕ ЕГЕУҚҰЙРЫҚТАР ТЕРІСІН ПАТОГИСТОЛОГИЯЛЫҚ ЗЕРТТЕУ

**Аннотация.** Жануарлардың химиялық күйіктерін зерттеу хирургияның күрделі проблемасы болып табылады. Үстірт және одан да тереңірек күйік жануардың өміріне қауіп төндіреді, өйткені жергілікті өзгерістерден басқа олар күйік токсемиясының пайда болуымен организмде жалпы бұзылулар тудырады және күйік жараларының бетінде патогендік микрофлораның көбеюіне септігін тигізеді. Мақалада патологиялық микрофлораны жарадан 7, 14 күн бойы белсенді түрде алып тастайтын, кө-

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### ПАТОГИСТОЛОГИЧЕСКОЕ ИЗУЧЕНИЕ КОЖИ КРЫС ПРИ ХИМИЧЕСКОМ ОЖОГЕ УКСУСНОЙ КИСЛОТОЙ

**Аннотация.** Изучение химических ожогов у животных представляют собой серьезную проблему в хирургии. Ожоги, даже поверхностные, и тем более глубокие быстро становятся угрожающими для жизни животного, поскольку помимо местных изменений, вызывают общие нарушения в организме возникновением ожоговой токсемии, а также размножением патогенной микрофлоры на поверхности ожоговых ран. В статье показано комплексное гистологическое исследование клеток кожи крыс при химическом ожоге уксусной кислотой на фоне использова-

міртек талшығының әсерінен микробқа қарсы әсері бар, көміртекті сорбент таңғышты қолдану аясында сірке қышқылымен химиялық күйік кезіндегі егеуқұйрық тері жасушаларын кешенді гистологиялық зерттеу көрсетілген. Сірке қышқылымен химиялық күйік кезінде көміртекті сорбентпен таңу материалдарын 7, 14 күн ішінде қолдану патологиялық процестердің төмендеуіне және егеуқұйрықтардың терісінде жалпы антиоксиданттық белсенділіктің жоғарылауына әкелетіні анықталды. Алынған мәліметтер микроорганизмдерге қатысты айқын сорбциялық әсер ете отырып, жараның секрециясын сіңіру қабілеті бар көміртекті сорбентті таңғыштарды қолдану күйік жарақаттарының жазылу жылдамдығына оң әсер етеді және дененің жалпы жағдайын жақсартатыны жайлы айтуға мүмкіндік береді.

**Кілтті сөздер:** күйік, медициналық таңғыш, сірке қышқылы, тері.

**Introduction.** Chemical burns of the skin occupy a prominent place in the structure of domestic and industrial injuries. Technological progress not only did not lead to a decrease in the number of burn injuries, on the contrary, the frequency of thermal, chemical injuries and mortality among those who were burned have a clear tendency to increase. Burns are often accompanied by man-made disasters and military conflicts. The number of burns received in everyday life is also not decreasing. It is generally recognized that the greatest danger to life is represented by extensive deep burns, accompanied by the development of severe burn disease. Therefore, traditionally, attention is paid to this problem. However, at present, there is a progressive growth of local deep burns, in which the affected area does not exceed 30% of the body surface [1-5]. Skin - cutis - an organ that is the outer covering of the body, which performs the function of protecting the body from external influences, metabolism, thermoregulation, etc. The skin covers the entire body of a rat, it is relatively thin, in an old animal it is thicker than in young animals, in males it is thicker than in females. In a rat, like in other mammals, the skin consists of a surface layer - the epidermis - epidermis, represented by a multilayer squamous keratinized epithelium, the dermis (corium) - the connective tissue part of the skin, and the subcutaneous base, or layer. The study of domestic and foreign literary sources has shown that chemical burns of the skin occupy a prominent place in the structure of domestic and industrial injuries. The most severe contingent of burned patients are patients with deep burns, which are accompanied by the development of burn disease. Traditionally, much attention is paid to the study of the pathogenesis and treatment of extensive burns, while the study of pathomorphological changes in limited burns, the affected area of which does not exceed 10% of the skin surface has been little studied [6-13]. Therefore, the morphological study of the skin with a chemical burn using physiotherapeutic methods aimed at preventing treatment is no less important problem. The conser-

vation of dressings with a carbon sorbent, which possess antimicrobial action, is carried out by the action of carbonaceous fiber, actively removing from the wound pathological microflora during 7, 14 days. It is established that the application of dressings with a carbon sorbent on the background of the use of acetic acid leads to a decrease in pathological processes and to an increase in the overall antioxidant activity in the skin. The obtained data allow us to speak about the application of carbon sorbent dressings, which possess the ability to absorb wound secretions, to express a sorption effect in relation to microorganisms, to ensure a positive influence on the rate of healing of a burn injury, to improve the general condition of the organism.

**Key words:** burn, therapeutic dressing, acetic acid, skin.

vative methods used in this regard, the most widespread in Kazakhstan, often turn out to be insufficiently effective. Acetic acid burn is one of the most serious injuries that can happen in everyday life. Poisoning or skin burns with vinegar essence are common. Our experiment on the morphological study of the skin of a rat with a chemical burn with acetic acid against the background of the use of dressings with a carbon sorbent makes it possible to assess not only the cytotoxic effect of the factor under study, but also to obtain fundamentally new information about the mechanisms of its action on the morphofunctional state of the rat organism.

**Modeling of chemical burn.** To carry out the experimental work of the study, we used white outbred rats at the age of three months with an average body weight of 180-220 g. A total of 18 rats, all were kept in the same standard vivarium conditions, received normal food, drank water without restriction. To apply wound damage, the skin area was first cleaned of hair. After preliminary removal of hair on the back of the skin, the experimental animals caused a chemical burn with acetic acid and received a third degree burn with an area of 6-9%. Experimental rats were divided into 3 groups of 6 animals each: the first control group of animals, where the skin of the rats was not exposed to chemical burns. The second group of experimental animals received a chemical burn of the skin with acetic acid. The third group of experimental rats who received a chemical burn of the skin with acetic acid while using medical dressings with a carbon sorbent on the damaged wound, which included vitamin A, E, diminished powder 3 g, olive oil 1 ml, petroleum jelly 1 g. Histological studies in order to identify morphological changes in the burned tissues in animals of the control and experimental groups, in the process of surgical treatment, tissue pieces were excised on the 7th and 14th days. For this, a biopsy of a burn wound was performed in rats with a burn injury on the 7th and 14th days after the injury was inflicted under anesthesia. Pieces of the skin of experimental rats served as the object of histological examination. His-

tological processing of the material was carried out by traditional methods of microscopic technique for preparing thin sections. Sections were stained with hematoxylin - eosin. Viewing and photographing of histological preparations was carried out using a Leica DMLS light microscope with a Leica DFS 280 digital camera.

**Research results and discussion.** A morphological study of control rats that did not undergo a chemical burn for 7 and 14 days showed that in the rats there were no changes in the skin cover without changes, there was no reddening of the skin, thickening of the skin fold and loss of hair adjacent to the clipped areas. On palpation of the clipped skin areas, no painful reaction was observed in the animals. There are no blood vessels in the epidermis. The cells are flattened, the nuclei are purple-stained with hematoxylin-eosin (Fig. 1). Signs of degeneration and keratinization are visible in the granular layer. On the surface of the epidermis, the scales peel off, but the thickness of the stratum corneum does not decrease from this, since the keratinization process constantly captures new

cell rows, and the loss is replenished due to the multiplication of cells of the basal layer (Fig. 2). The physiological state of the animals of the first group during the study period remained within the normal range.

Pathohistological changes in the skin of the second group of rats that received a chemical burn with acetic acid on the 7th day of observation, fibrin scab with lymph and leukocyte infiltration was visualized (Figure 3). Extensive areas of necrosis, edema, profuse mononuclear and neutrophilic infiltration were found in the dermis. Sebaceous glands and hair follicles were completely absent in places. In the area of necrosis, an inflammatory process is traced, all structural elements of the dermis are well visualized, including the connective tissue matrix, vessels and skin appendages.

Necrotic tissues are optically dense, with an intense basophilic shade. Histological examination of the skin of rats on the 14th day after the burn, hyperkeratosis was observed in the stratum corneum of the epidermis. The hyperplastic prickly layer was visualized. On the border of

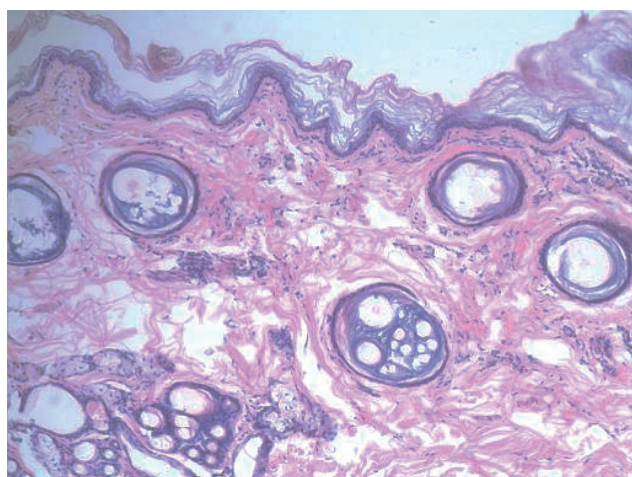


Figure 1 - Skin without changes, 7 days. Hematoxylin-eosin. X 400.

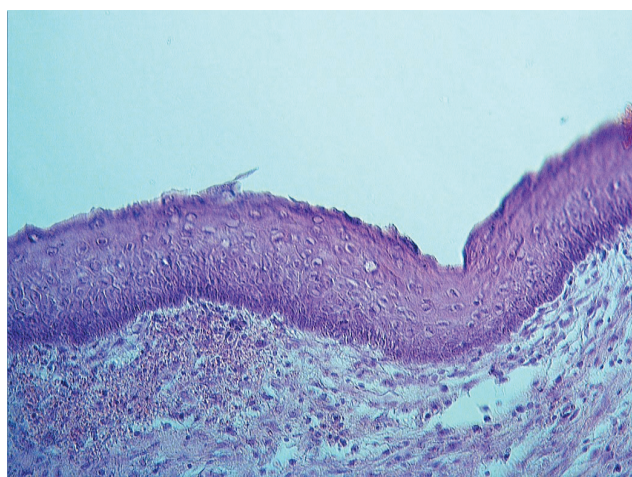


Figure 2 - The skin was unchanged, 14 days. Hematoxylin-eosin. X 400.

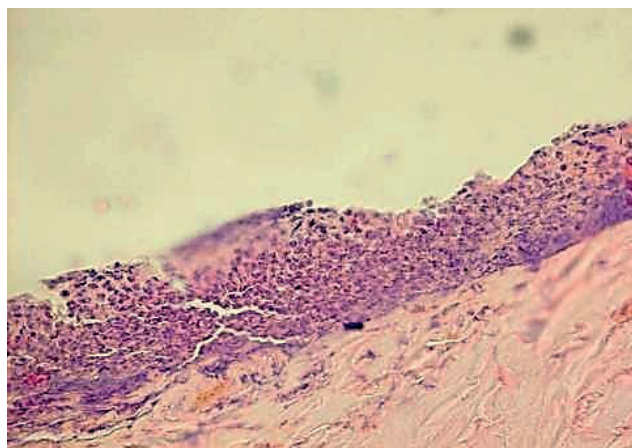


Figure 3 - Fibrinous scab with moderate lymphocytic infiltration. 7 days Hematoxylin-eosin. X 400.

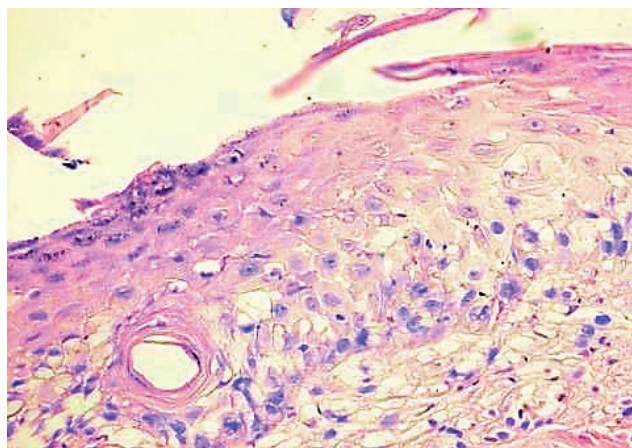


Figure 4 - Focal hemorrhage in the superficial layers of the dermis, 14 days. Hematoxylin-eosin. X 400.

the epidermis and dermis, also in the superficial dermal layers, focal hemorrhages (Figure 4) and focal fibrosis were determined. In the deep dermal layers, swelling of the connective tissue fibers was observed. Mononuclear and neutrophilic infiltration of the dermis was poorly expressed, judging by single or few focal cell clusters. There were single keratinocytes and sebaceous glands without complete epithelialization of the defect. The physiological state of the rats of the second group after a chemical burn showed a depressed general state, decreased appetite, and increased respiration. A histological study of the skin of rats of the third group with a chemical burn with acetic acid against the background of the use of dressings with a carbon sorbent for 7 days showed that no signs of purulent exudation were found in the animals, the burn wounds of this group were covered with a thin dry scab. The thorny layer was hyperplastic, there were single acanthotic strands, and focal fibrosis with weak mononuclear infiltration and the absence of neutrophils was observed in the dermis. The underlying layers of the dermis included the papillary and reticular layers, consisting of fibroblasts and fibrocytes (Figure 5) without pathological changes. Morphological study of rats after 14 days there was a mild diffuse infiltration of the granulation tissue of the wound with lymphoid elements. The granulation tissue of the healing burn wound was characterized by the predominance of cellular elements over collagen fibers, complete epithelialization of the burn due to hyperplasia of the thorny layer was noted, and partial signs of dystrophic changes were noted. The inflammatory reaction in the skin itself was poorly expressed (Figure 6). The physiological state showed that the body temperature returned to normal, the animals' appetite was satisfactory, the animals' respiration rate remained within the physiological limits and did not differ significantly, on the 14th day they were within the normal range. When studying the rates of wound healing and morphological signs of the wound process in the experimental groups, we noted a slowdown in the phases of the wound process with-

out the use of a dressing, the healing time of necrotic tissues and the period of cell infiltration were lengthened in comparison with a medical dressing with a sorbent. The use of a dressing with a sorbent contributed to a decrease in the concentration of microbial bodies, accelerated the process of epithelialization of a dermal chemical burn, the frequency of scar complications was reduced to 20%. Conclusion. Despite the large selection of drugs used for the local treatment of burns in animals, none of them can be called universal, and the effect is far from optimal. In this regard, treatment should include pain relief and be aimed at combating infection and intoxication of the body. It should be borne in mind that at different stages of the healing of a burn wound, different principles of therapy should be applied, on which the choice of local remedies for treating a burn depends. In this regard, our study shows that the study of chemical burns with acetic acid of the second group of rats revealed pathomorphological features of the course of the wound process in the form of destruction, necrosis, inflammation, and under the conditions of an experimental combined scheme of chemical burns against the background of the use of sterile dressings with a special sorbent no destructive changes were observed. Our study revealed local changes in the structure of the skin after exposure to a chemical factor. This scientific experiment gave a positive assessment of the effectiveness of using a new method of treating skin burns with a therapeutic bandage with a sorbent, which included vitamin A, E, diminished powder 3 g., Olive oil 1 ml., Petroleum jelly 1 g. In the third group of rats, the thickness of the germ the layer of the epidermis in the zone of epithelialization of the wound surface is significantly higher and the acceleration of the healing rate of burn wounds is achieved due to the weakening of the severity of the destructive-inflammatory phase of the wound process and the activation of the proliferative-reparative phase. The effect of dressings on wound healing was more pronounced. Bandaged rats were more active than unbandaged rats. The use of a sorbent dress-

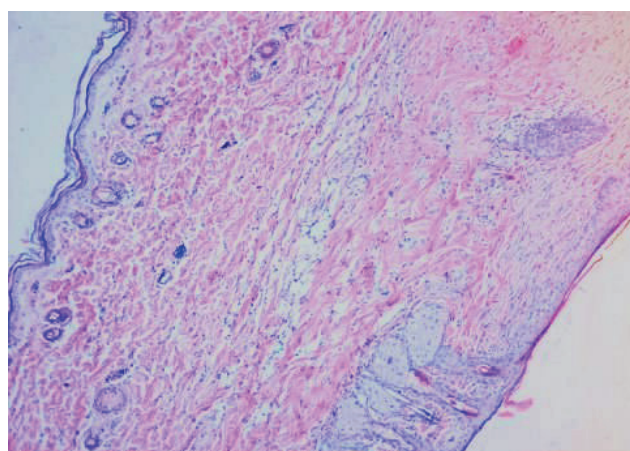


Figure 5 - Chemical burn after treatment with a bandage with a sorbent after 7 days. Focal fibrosis was observed in the dermis. Hematoxylin-eosin. X 400.

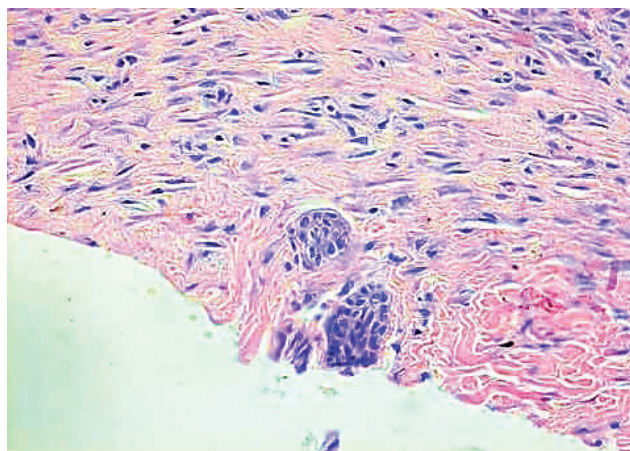


Figure 6 - Chemical burns after treatment with a bandage with a sorbent after 14 days. Focal fibrosis is observed in the dermis. Hematoxylin-eosin. X 400.

ing contributed not only to a reliable acceleration of healing, but also to a reduction in the range of epithelialization periods, healing took place under a dry scab, providing a more effective wound healing effect. It was revealed that our experiment of morphological study of rat skin with a chemical burn with acetic acid against the background of the use of dressings with a carbon sorbent makes it possible to assess not only the cytotoxic effect of the factor under study, but also to obtain fundamentally new information about the mechanisms of its action on the morphofunctional state of the rat organism. It was found that the regeneration of damaged tissues in rats by a burn with acetic acid during treatment with a bandage with a carbon sorbent for 7 days leads to wound healing, and by 14 days completely scarring of the tissue occurs. The results obtained allow us to speak about the unique properties of sorbent carbon dressings, which have a good ability to absorb purulent secretions, reducing bacterial contamination of the wound, trophic ulcers, and completely

eliminating the smell of exudate. The carbon sorbent creates the conditions necessary for the prevention of complications of primary injuries.

Findings: It was proved that in the burnt skin tissues of rats of the third group in the early stages there is a rapid maturation of granulation tissue, active regeneration of the skin with a predominance of reparative processes, less pronounced exudative phase of the inflammatory reaction. It was found that the use of a dressing with a sorbent contributed to a decrease in the concentration of microbial bodies, accelerated the process of epithelialization of a dermal chemical burn, and the frequency of cicatricial complications was reduced to 20%. It was shown that the use of a sorbent dressing contributed not only to a significant acceleration of healing, but also to a reduction in the range of epithelialization periods, healing took place under a dry scab, providing a more effective wound healing effect.

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