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STRUCTURAL AND FUNCTIONAL CHANGES IN THE LUNG OF RATS AFTER POISONING WITH TOXIC SUBSTANCES

Resume. At industrial facilities, accidents and man-made disasters are accompanied by the release of highly toxic pulmonotoxicants into the environment. At a high level of exposure, a toxic process is formed, damage to the respiratory system in the body. The article shows that when exposed to chlorine for 30 days, respiratory tract damage and structural and functional changes in the lung of rats are observed. The toxic effect of chlorine on the epithelial cells of the respiratory tract and the endothelium of the capillaries of the lungs of rats can be associated with the manifestation of its oxidizing properties. In addition, chlorine disrupts enzymatic reactions in tissues, inactivates oxidative defense enzymes, and changes the structure. Histological examination in the lungs of rats of the second group revealed venous stasis, alveolar edema, hemorrhages, and the use of a detoxifying product reduced the degree of pulmonary hydration and a decrease in the manifestation of pathological processes by increasing the antioxidant reserves of the lungs. In the course of the experiment, the efficacy and safety of a specialized detoxifying product combining bronchodilator, antispasmodic, immunomodulating and antioxidant properties for the prophylactic treatment of lesions of the respiratory system was revealed.

Keywords: lungs, morphology, dietary supplements, antioxidant, chlorine.

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УЛЫ ЗАТТАРМЕН УЛАУ КЕЗІНДЕ ЕГЕУҚҰЙРЫҚТАР ӨКПЕСІНІҢ ҚҰРЫЛЫМДЫҚ-ФУНКЦИОНАЛДЫҚ ӨЗГЕРІСІ

Түйін: Өндірістік нысандарда апаттар мен техногендік апаттар қоршаған ортаға өте улы пульмонотоксиканттардың бөлінуіне себепші болады. Әсер етудің жоғары деңгейінде токсикалық процесс - организмдегі тыныс алу жүйесінің зақымдануы туындайды. Мақалада хлормен 30 күн әсер еткенде тыныс алу жолдарының зақымдануы және егеуқұйрықтардың өкпесінде құрылымдық-функционалдық өзгерістер байқалатындығы көрсетілген. Хлордың тыныс алу жолдарының эпителий жасушаларына және егеуқұйрықтардың өкпе капиллярларының эндотелийіне уытты әсері оның тотықтырғыштық қасиеттерінің көрінуімен байланыстыруға болады. Сонымен қатар, хлор тіндердегі ферментативті реакцияларды бұзады, тотығу қорғаныс ферменттерін инактивациялайды және құрылымын өзгертеді. Екінші топтағы егеуқұйрықтардың өкпесін гистологиялық зерттеу кезінде веноздық стаз, альвеолярлы ісіну, қан кетулер анықталды және

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СТРУКТУРНО-ФУНКЦИОНАЛЬНЫЕ ИЗМЕНЕНИЯ ЛЁГКОГО КРЫС ПРИ ОТРАВЛЕНИЯ ТОКСИЧЕСКИМИ ВЕЩЕСТВАМИ

Резюме. На промышленных объектах аварии и техногенные катастрофы сопровождаются выбросом в окружающую среду высокотоксичных пульмонотоксикантов. При высоком уровне воздействия формируется токсический процесс, поражения дыхательной системы в организме. В статье показано, что при воздействии хлора в течение 30 дней наблюдается поражение дыхательных путей и структурно-функциональные изменения лёгкого крыс. Токсическое действие хлора на эпителиальные клетки дыхательных путей и эндотелий капилляров лёгких крыс можно связать с проявлением его окислительных свойств. Помимо этого, хлор нарушает ферментативные реакции в тканях, инактивирует ферменты оксидантной защиты, изменяет структуру. При гистологическом исследовании в лёгких крыс второй группы выявлен венозный стаз, альвеолярный отёк, кровоизлияния, а применение детоксицирующего продукта снизило сте-

детоксикация құралын қолдану өкпенің антиоксидантты қорын жоғарылату арқылы өкпе гидратациясы дәрежесін азайтып, патологиялық процестердің көрінісін төмендетеді. Тәжірибе барысында тыныс алу жүйесінің зақымдануларын профилактикалық емдеу үшін бронхолитикалық, спазмолитикалық, иммуномодулярлық және антиоксидантты қасиеттерді біріктіретін мамандандырылған ұйтсыздандыратын өнімнің тиімділігі мен қауіпсіздігі анықталды.

Түйінді сөздер: өкпе, морфология, тағамдық қоспалар, антиоксидант, хлор.

Introduction. When exposed to high chlorine concentrations and prolonged exposure, the lower respiratory tract is also affected. Intense irritation of the receptor field of the respiratory tract causes a reflex reaction from the smooth muscles of the trachea, bronchi, as well as the respiratory and vasomotor centers. First of all, the epithelium of the upper respiratory tract is affected, and then the epithelial lining of the alveoli. The epithelium swells, degenerates, which leads to its necrosis and complete suppression of mucociliary clearance [1-5]. It is also known that the selective effect of chlorine on type 2 pneumocytes, leading to a decrease or even a complete cessation of surfactant secretion. Damage to the surfactant system leads to the development of massive atelectasis. Under normal conditions, the oxidase system of type 2 pneumocytes protects the surfactant system and the cells themselves from chemical agents and free oxygen radicals. But exposure to chlorine and its hydrolysis products, which are strong oxidants, destroys this protection. The destruction of type 1 pneumocytes leads to an increase in the permeability of the alveolar wall for water, macromolecules and blood cells. The fibrin contained in the edematous fluid is involved in the breakdown of the surfactant. In parallel, there is a violation of blood circulation in the thickness of the mucous membranes of the respiratory tract and diffuse damage to the endothelium of the pulmonary capillaries. This leads to a change in the permeability of the endothelial membrane. As a result, the movement of plasma through the capillary wall occurs in pathological ways through the damaged endothelium. An increase in the level of oxidants, metabolic products of destroyed endothelial cells of the lung capillaries, progressive hypoxia initiate the destruction of mast cells, which is accompanied by a massive release of biologically active substances - histamine, acetylcholine, serotonin, bradykinin, heparin, etc. [6-11]. Despite the research carried out in this area, the problem of treating toxic pulmonary edema remains highly relevant. This is due to the fact that in case of mass poisoning with such widespread in industry compounds as chlorine, ammonia, phosgene, nitrogen oxides, a number of acids, the development of toxic pulmonary edema determines the severity and prognosis of intoxication. The most promising prophylactic method for intoxication with toxic substances is the use of biologically active additives, which makes it possible to improve the general condition, bypassing the organs of detoxification and places of nonspecific binding. Based on the above, we have created a model for the study of structural and functional changes in the lung of rats receiving a specialized detoxifying product against the background of chlorine poisoning for 30 days.

пень лёгочной гидратации и уменьшение проявления патологических процессов за счёт повышения антиоксидантных резервов лёгких. В ходе выполнения эксперимента выявлена эффективность и безопасность применения для профилактического лечения поражений дыхательной системы специализированного детоксицирующего продукта, сочетающего в себе бронхолитические, спазмолитические, иммуномодулирующие и антиоксидантные свойства.

Ключевые слова: лёгкие, морфология, бады, антиоксидант, хлор.

Material and research methods. The experimental study was carried out on the basis of the laboratory of evolutionary and ecological morphology of the al-Farabi Kazakh National University. For the experiment, rats were formed at the age of 3 months, according to the principle, taking into account age and weight. The experiment involved 30 rats, which were divided into three groups: control, two experimental. Rats were housed 10 individuals in cages on a litter of fine wood shavings. The animals were fed twice a day. The controls received the usual basic diet, the second group received 10 mg / l of chlorine with water, the third group received 10 mg / l of chlorine with water in combination with a detoxifying specialized product at a dose of 100 grams, the recipe for which consists of beets 25g, carrots 25g, pumpkin 20g, apples 20g, sugar 8g, mineral impurities 2g. All groups of animals were kept in standard vivarium conditions without restriction of food and water consumption. After 30 days, the animals were removed from the experiment by pickling under ether anesthesia in accordance with ethical standards and recommendations for the humanization of work with laboratory animals reflected in the "European Convention for the Protection of Vertebrate Animals used for Experimental and Other Purposes". Histological material was recorded in 10% buffered formalin solution (pH 6.8-7), dehydrated in alcohols of ascending strength, embedded in paraffin blocks, from which sections with a thickness of 4-5 μm were prepared on a Leica RM 2145 microtome. Histological sections were stained with hematoxylin and eosin, and PAS was also performed. The study of histological sections was carried out using a Leica DM6000 B microscope [12].

Results. Histological examination of the respiratory part of the lungs of the rats of the control group on semi-thin sections showed that the structure of the lungs is preserved, they consist of airways and the respiratory part with a characteristic structure. The walls of the medium-sized bronchi are covered with a single-layer, multi-row ciliated epithelium. The own layer of the mucous membrane consists of loose connective tissue. Acini are visible located in the walls of the alveoli. The air-conducting section is short, represented by bronchi of 3-5 orders, divided into small bronchi and bronchioles. The mucous membrane of the bronchial wall is lined with ciliated epithelium, which, as the caliber decreases, changes shape, turning from a high prismatic epithelium into a low cubic epithelium (fig. 1). Physiological abnormalities were not observed. The general condition of the animals was satisfactory, the coat was uneven, baldness was visible in some places. The weight is preserved, the pupils are slightly reddened. Morphological study of experimental animals

of the second group, which received 10 mg / l chlorine with water without using a specialized detoxifying product for 30 days, was observed in lung cells destructive, pathological changes in the form of alveolar edema, subpleural hemorrhage (fig. 2). The walls of a large bronchus are thickened due to edema and inflammation. First of all, the epithelium of the upper respiratory tract is affected, and then the epithelial lining of the alveoli. The epithelium swells, degenerates, which leads to its necrosis (Fig. 3). Physiological observation showed pronounced symptoms of irritation of the eyes, open areas of the skin and upper respiratory tract, which were combined with lethargy, lateral position of the body. There was a slight ataxia, there were short periods of motor excitement with the development of rapidly passing clonic seizures.

On histological preparations of organs of experimental rats of the third group, which received a specialized detoxifying product for a month, it was found that there were no visible morphological disorders from the alveolar epithelium of bronchioles in the lungs (Fig. 4). In the tissues of the lung, the structure of the structure is preserved. The epithelium is without visible changes, vacuoles are visible in the cytoplasm, the nuclei are indistinct, blurred, swollen. The lumen of the alveoli is normal. The epithelial lining of the bronchi is preserved, the vessels are slightly congested, punctate hemorrhages and initial interstitial edema (Fig. 5).

Therefore, it can be seen on histological preparations that poisoning of animals with chlorine in the lungs is observed necrosis, degeneration, edema, violation of the integrity of cells, strong destructive changes. There is a violation of blood circulation in the form of plethora, plasmorrhage. At the joints between

the swollen acini, there is an interstitial tissue rich in blood vessels. And the use of a specialized detoxifying product for intoxication of rats with chlorine showed an increase in the immunity of animals, facilitated the course of intoxication and a decrease in hydration of the lung tissue, and also had a positive effect on the state of the respiratory system. In this case, it can also be assumed that a specialized detoxifying product prevents or reduces the severity of toxic pulmonary edema, no special changes were noted. In the lungs of the alveolar epithelium, there is a slight swelling of the nuclei, the lumen of the alveoli is unchanged.

Conclusion. Experimental studies have made it possible to assess the effectiveness, completeness of the therapeutic effect, the effect on the structural and functional changes caused by chlorine in the lung parenchyma. In experiments on rats, key indicators of the effectiveness of treatment with chlorine lesions were determined. It was shown that the use of a specialized detoxifying product had a positive effect on increasing the immunity of animals when inoculated with chlorine, reduced the degree of pulmonary hydration, and reduced the manifestation of bronchial obstruction by increasing the antioxidant reserves of the lungs. Physiological abnormalities were not observed. The general condition of the animals was satisfactory, the coat was uneven, baldness was visible in some places. The weight is preserved, the pupils are slightly reddened. In this case, it can also be assumed that a specialized detoxifying product prevents or reduces the severity of toxic pulmonary edema, no special changes were noted. In the lungs of the alveolar epithelium, there is a slight swelling of the nuclei, the lumen of the alveoli is unchanged.

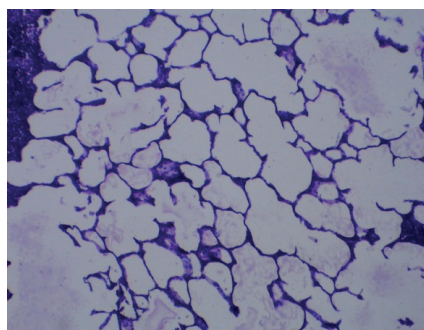


Fig. 1. The histological structure of the respiratory part of the lungs is normal. Hematoxylin-eosin. X 210.

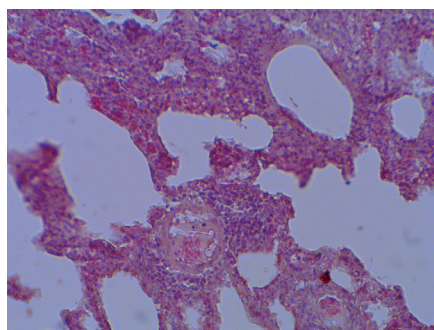


Fig. 2. The walls of the bronchus are thickened due to edema and inflammation. Hematoxylin - eosin. X 210.

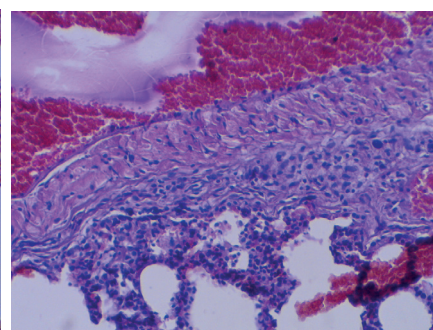


Fig. 3. Necrosis, degeneration and swelling of the epithelium. Hematoxylin-eosin. X 210.

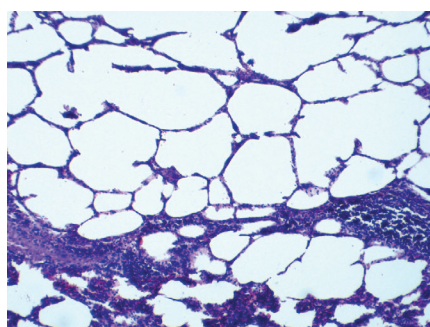


Fig. 4. The epithelial lining of the bronchi is preserved, the vessels are slightly congested. Hematoxylin - eosin. X 210.

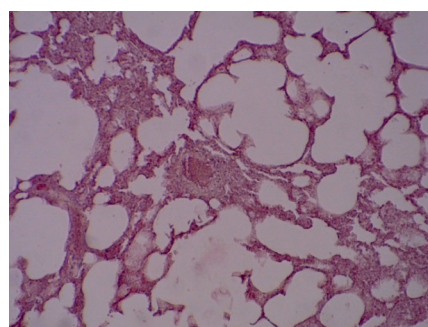


Fig. 5. The epithelial lining of the bronchi is preserved, the vessels are slightly congested. Hematoxylin - eosin. X 200.

Findings:

1. Chronic chlorine poisoning of rats in the experiment causes destructive changes in the studied lungs of animals of the second group. There is plethora of blood vessels, edema, hemorrhage in the interalveolar septa, fragmentation.
2. Insignificant changes in the lung structure of rats of the third group in the experiment when feeding a specialized detoxifying product were focal in nature.
3. It was revealed that a specialized detoxifying product has targeted bronchodilator, antispasmodic, immunomodulatory and an-

- tioxidant properties that increase the body's adaptive capabilities.
4. It was found that feeding rats with a detoxifying specialized product in case of chlorine poisoning of rats increased immunity, a decrease in intoxication and hydration of lung tissue was observed.
5. It was proved that the study of the lung of rats showed the pathomorphological essence of the process and made it possible to conduct an experiment. The use of a specialized detoxifying product significantly reduced the negative effect on the pathological changes in the lungs of rats.

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