

Morphometric Changes in Lung Tissue During Chemical Burn of the Digestive Tract

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Annotation. Lung pathology is quite widespread and has been studied in detail by both clinicians and morphologists. But morphometric changes in lung tissue during a chemical burn of the digestive tract have been poorly studied and require further research. In case of a chemical burn of the digestive tract with acetic acid, such morphological changes were revealed as pulmonary edema, a decrease in the volume fraction of the alveoli, destroyed epithelial cells and red blood cells were detected in the lumen of the alveoli, thickening of the interalveolar septa and an increase in their volume fraction were noted, which is associated with dystrophic changes in the alveolocytes and endothelium of the blood vessels. blood vessels and swelling of the interstitial tissue of the alveoli. As a result of developed edema and destructive changes, the relative volume of collagen and reticular fibers in the lung stroma decreases. A slight leukocyte infiltration is detected paravasally.

Key words: acetic acid, lungs, edema, morphology, white rats.

Relevance. Currently, chemical burns of the digestive tract of varying severity represent a very pressing medical, social and economic problem. Severe burns of the upper gastrointestinal tract affect 10-33% of adult patients, mortality is up to 10% [Rollin M. et al. 2015].

According to the American Association of Poison Control Centers, more than 1.6 million children were poisoned in 2008 alone, and alkaline burns to the esophagus were recorded in 18-46% of cases after consuming various household chemicals [George D et al 2013].

The risk of developing esophageal stenosis for burns of I, IIa and IIb degrees was 0%, 17% and 83%, respectively. Patients with third-degree burns generally underwent esophageal resection and were therefore excluded from the study. Early burn scores showing full-thickness necrosis have also been validated as predictors of post-burn stenosis.

Late effects of burns include retrograde changes in the oral cavity, esophagus, stomach or respiratory system. In addition, it can lead to the formation of strictures in organs. The formation of strictures can have serious systemic consequences for the patient, including poor general condition, significant weight loss, malnutrition, recurrent aspiration leading to respiratory infections, and potential respiratory failure [Cheng H.T. et al., 2018].

The purpose of the study is to determine the morphometric changes in the lung tissue of white rats after burns with acetic acid.

Materials and methods of research. For the study, 60 white outbred rats of 5 months of age were used. A 30% aqueous solution of acetic acid in an amount of 0.5 ml was used as a cauterizing poison, which in terms of the pure substance is less than LD25 for rats, causing mild poisoning [2, 7]. The material for the study was taken on days 1, 3, 5, 7, 10 and 14 after taking the toxic substance. Lung fragments were fixed in 10% neutral formalin, passed through alcohols and

embedded in paraffin. The prepared microslides were stained with hematoxylin-eosin and picrofuchsin according to the Van Gieson method [3]. Reticular fibers were identified by imperegation with silver nitrate using the Bielschowsky method modified by Yurina. Light microscopy and morphometric studies of sections were carried out at a magnification of 200 times according to the method of G.G. Avtandilov [1]. In the lungs, the volume fraction of alveoli, interalveolar septa, intra-alveolar exudate, blood vessels, collagen and reticular fibers, as well as the intensity of leukocyte infiltration were determined.

Research results. One day after poisoning, the animals showed signs of pulmonary edema. This was expressed in a decrease in the volume fraction of the alveoli to $51.3 \pm 0.74\%$ of the initial values. There is exudate in the alveoli, the volume fraction of which is $8.7 \pm 0.14\%$. In the lumen of the alveoli, destroyed epithelial cells and red blood cells are detected. Single alveoli are atelectatic or completely filled with exudate. There is a thickening of the interalveolar septa and an increase in their volume fraction to $22.8 \pm 0.75\%$, which is associated with degenerative changes in alveolocytes, endothelium of blood vessels and swelling of the interstitial tissue of the alveoli. As a result of developed edema and destructive changes, the relative volume of collagen and reticular fibers in the lung stroma decreases to $2.44 \pm 0.32\%$ and $5.02 \pm 0.17\%$. The lungs of experimental animals are full of blood. The volume fraction of vessels increases to $9.3 \pm 0.32\%$. Paravasally, a slight leukocyte infiltration is determined, averaging 7.7 ± 0.16 cells per 10,000 square meters. μm .

On the 3rd day after poisoning with acetic acid, signs of damage remain in the lung tissue, and in some studied parameters it intensifies. Thus, the volume fraction of intra-alveolar exudate increases to $9.08 \pm 0.15\%$. Leukocyte infiltration of the lung stroma increases to $11.1 \pm 0.18\%$. The volume fraction of the alveoli decreases to $52.6 \pm 0.83\%$ of the initial values. The volume fraction of reticular fibers is $4.82 \pm 0.17\%$.

On the 5th day, when studying the histological structure of the lungs in this group of animals, activation of reparative processes was noted. There is an increase in the volume fraction of the alveoli to $61.2 \pm 1.13\%$. The thickness of the interalveolar septa decreases - their volume fraction is $19.7 \pm 0.58\%$. The volume fraction of intraalveolar exudate still remains high and reaches $4.7 \pm 0.31\%$. The lungs of experimental animals are less full-blooded than in previous periods. The volume fraction of blood vessels decreases to $5.6 \pm 0.14\%$. Fragments of endothelial cells are detected in the vessels. The remaining infiltration of the lung parenchyma is represented by mononuclear cells, the number of which is 6.2 ± 0.18 cells per 10,000 square meters. μm . There is a tendency to restore the connective tissue stroma of the lung as a result of an increase in the relative volume of collagen and reticular fibers to $4.1 \pm 0.12\%$ and $6.1 \pm 0.13\%$, respectively.

On the 7th day after administration of the toxic substance, there was a further increase in the volume fraction of the alveoli to $71.0 \pm 0.84\%$ of the initial values. This indicator is affected by both a decrease in the thickness of the interalveolar septa due to a decrease in tissue edema, and a decrease in the proportion of the vascular component. The relative volume of blood vessels decreases to $3.8 \pm 0.17\%$. Exudate in the alveoli remains and amounts to $3.1 \pm 0.17\%$. No red blood cells are found in the lumen of the alveoli, but a small number of epithelial cells remain. Leukocyte infiltration decreases and amounts to 6.6 ± 0.14 cells per 10,000 square meters. μm . The volume fraction of collagen fibers increases to $3.01 \pm 0.15\%$.

By the 10th day in experimental animals, the volume fraction of the alveoli is restored to $69.6 \pm 1.16\%$. The volume fraction of exudate inside the alveoli decreases and amounts to $1.2 \pm 0.18\%$. Single atelectatic alveoli are identified, which were probably initially severely damaged, since at this time of the study fibroblasts are localized around them. The volume fraction of the

interalveolar septa is $21.2 \pm 0.22\%$. The volume fraction of blood vessels still exceeds normal values and amounts to $3.95 \pm 0.13\%$. Perivascular edema decreases. Infiltration remains in the lung tissue; cellular elements are represented mainly by lymphocytes in the amount of 5.8 ± 0.14 cells per 10,000 sq. μm .

On the 14th day, further restoration of the morphological structure of the lungs is observed. The volume fraction of the alveoli is $71.02 \pm 0.74\%$. The volume fraction of exudate inside the alveoli is relatively small - $0.7 \pm 0.08\%$. There are no red blood cells or alveolocytes in the exudate. The volume fraction of the interalveolar septa did not change in comparison with the previous period of the study. The volume fraction of blood vessels is only $3.2 \pm 0.15\%$. The volume fraction of collagen and reticular fibers is $3.7 \pm 0.25\%$ and $5.82 \pm 0.18\%$, respectively.

Conclusions. In case of a chemical burn of the digestive tract with acetic acid, such morphological changes were revealed as pulmonary edema, a decrease in the volume fraction of the alveoli, destroyed epithelial cells and red blood cells were detected in the lumen of the alveoli, thickening of the interalveolar septa and an increase in their volume fraction were noted, which is associated with dystrophic changes in the alveolocytes and endothelium of the blood vessels. blood vessels and swelling of the interstitial tissue of the alveoli. As a result of developed edema and destructive changes, the relative volume of collagen and reticular fibers in the lung stroma decreases. A slight leukocyte infiltration is detected paravasally.

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