



EXPERIMENTAL MORPHOLOGICAL STUDY OF THE EFFECTIVENESS OF WOUND COATINGS FOR AERO- AND HEMOSTASIS

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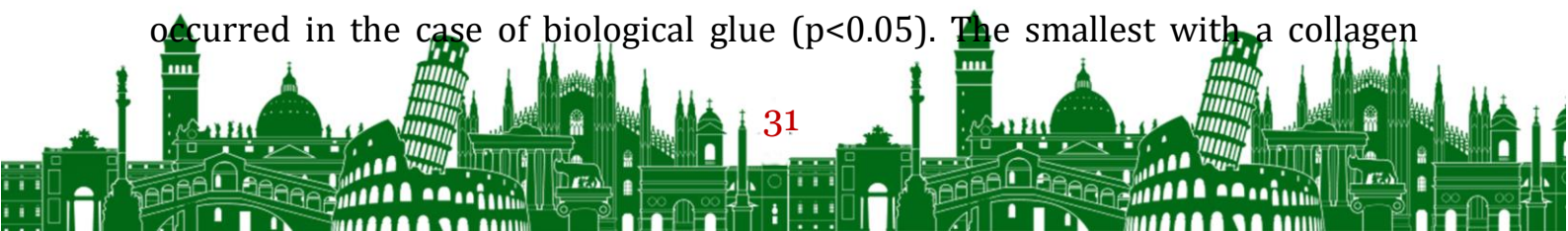
Abstract. The problem of aerostasis after surgical interventions on the lungs remains unresolved. A comparative assessment of the effectiveness of wound coatings for aero- and hemostasis was carried out. The new method of aerostasis consisted in attaching a light free flap of the parietal pleura to the wound surface, and its fixation was ensured due to the high adhesive ability of Hemoben. In studies, it was found that the new method of aerostasis, along with hemostasis, promotes rapid healing of a wound defect in the lungs, reduces the likelihood of formation of moorings and adhesions in the pleural cavity with restoration of the functional ability of the operated lung.

Key words: experimental morphological study; aero- and hemostasis; alveolar-pleural fistulas; postoperative complications; Hemoben.

The problem of aerostasis after surgical interventions on the lungs remains unresolved. Methods of achieving aerostasis must meet many requirements, among which the most important is biological compatibility, fast and stable aerostasis, the coating should not interfere with the excursion of the lungs. Despite advances in surgical technologies and methods, this complication is the main cause of the development of empyema, pneumonia, prolonged drainage and hospitalization, as well as unsatisfactory surgical outcomes [1-4]. At the same time, the mortality rate in case of aerostasis failure is 1-12% [5].

Material and methods. A comparative assessment of the effectiveness of wound coatings for aero- and hemostasis was carried out. Experimental studies included three series: in vitro, to assess the degree of adhesion of coatings in a humid environment; ex vivo, to study the effectiveness of wound coatings to achieve aerostasis on isolated sheep lungs; in vivo, to study the reaction of biological tissues and lung wound healing in an experiment on laboratory rats. 3 types of coatings were used: Biological glue (based on cyanocrylate) in liquid form, collagen sponge (Turon Silk Pharm LLC) measuring 4x4 cm, hemostatic implant "Hemoben" in the form of a powder from cellulose derivatives.

The results of the studies demonstrated that the greatest adhesion occurred in the case of biological glue ($p < 0.05$). The smallest with a collagen





sponge coating ($p < 0.01$). "Hemoben" occupied an intermediate position ($p < 0.05$). It should be noted that the presence of the coating in saline significantly reduced the strength of adhesion. The degree of adhesion reduction was greatest in the case of collagen (by 2 times) and lowest in the adhesive coating (less than 20%). According to the results of the following studies, biological glue has the highest density – 1.74, "Hemoben" – 0.74 and the lowest collagen – 0.34.

In vitro studies have found that the greatest adhesion and strength, as well as durability, provided the test sample is immersed in water, was achieved using biological glue; the next value in adhesion was achieved by the Hemoben coating, however, the degree of adhesion strongly depended on the time the coating was in water because the drug is water-soluble; the weakest coating to achieve The aerostasis turned out to be a collagen sponge, which has weak adhesion, and also easily slips off in water.

Sheep lungs were used in ex vivo experiments. Testing the effectiveness of the coatings showed that the formation of a lung wound and subsequent artificial ventilation with immersion of the lungs in saline bring the experiment closer to clinical conditions. In these studies, the results of in vitro studies were confirmed, however: the use of an adhesive coating led to deformation of the lung, limiting its excursion, and also required a significant amount of glue to achieve a film coating on the wound surface; the duration of aerostasis was highest when using cyanacrylate glue. However, it should be taken into account the fact that the glue becomes glassy and does not dissolve, as a result it becomes a foreign body that contributes to infection of the wound; Hemoben powder quickly forms a dense and effective coating on the surface of the lung wound with the achievement of full aerostasis, however, the effect was short-lived due to the solubility of Hemoben in water; coating from collagen proved ineffective in achieving aerostasis from a lung wound.

The new method of aerostasis consisted in attaching a light free flap of the parietal pleura to the wound surface, and its fixation was ensured due to the high adhesive ability of Hemoben. Ex vivo studies have demonstrated the high efficiency of the new method, which is characterized by the rapid formation of the coating within 1 minute, whereas the adhesive coating is formed within 5-7 minutes. The advantage is also the ability to form a coating in a humid environment, which is not acceptable when using biological glue. The next advantage is the elasticity of the coating, which does not interfere with the excursion of the lungs and does not deform the tissues.



In vivo studies have found that the new method of aerostasis, along with hemostasis, promotes rapid healing of a wound defect in the lungs, reduces the likelihood of formation of mooring and adhesions in the pleural cavity with restoration of the functional ability of the operated lung; when attaching a part of the pleura taken for aerostasis to the area of lung damage under the influence of powder, dense fusion occurs, resulting in stable aerostasis occurs. The restructuring of damaged tissue in the wound area under the influence of static aerostasis is manifested by obvious morphological signs, starting from the 3rd day of the experiment and ending with 7 days; the detection of homogeneous masses in the spaces of injured alveoli is a sign of persistent hemostasis in the injury zone; in the control group, a different level of adhesions between the lung injury zone and the pleural cavity persisted until 14 the day of the experiment depends on the area of damage. In the experimental group, adhesions between the parietal pleura in the area of injury and the parietal pleura in the chest were not observed. The main reason for this is that the pleura in the affected area is the same histological tissue, and the anatomical and physiological state is being restored. As a result, there is no spike formation between them.

Conclusion. In studies, it was found that the new method of aerostasis, along with hemostasis, promotes rapid healing of a wound defect in the lungs, reduces the likelihood of formation of moorings and adhesions in the pleural cavity with restoration of the functional ability of the operated lung.

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