EXPERIMENTAL SUBSTANTIATION OF THE POSSIBILITY OF INJECTING A GEL SUBSTANCE INTO LUNG TISSUE TO ACHIEVE AEROSTASIS

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Abstract. Currently, substances used in clinical practice for local strengthening of the damaged lung area are often characterized by insufficient effectiveness and unidirectional effects. Taking into account the new method of using the implant to eliminate the failure of aero- and hemostasis, which had not been previously performed, the possibility of using the hemostatic drug Hemoben in the form of a gel for injection into lung tissue was initially studied. Toxicological studies have revealed that 3.3% Hemoben gel injected into the lung parenchyma at a dose of 1 ml per 1 g does not have an irritating and toxic effect. Thus, the proposed technique is characterized by the effectiveness and safety of its use, and the results obtained make it possible to apply this method in clinical practice.

Keywords: experimental studies; failure of aero- and hemostasis; Hemoben; with intraparenchymal administration; to achieve aerostasis;

Currently, substances used in clinical practice for local strengthening of the damaged lung area are often characterized by insufficient effectiveness and unidirectional effects. Many of these coatings are made of biological materials (animal or plant origin), which causes their high antigenicity, as well as destruction during thermal sterilization. In this regard, at the present time, it is necessary to continue the development of new biocompatible coatings and methods of their application. The ideological basis for this study was the possibility of developing a new method for ensuring the tightness of sutures in lung surgery, namely, reducing the risk of manifestations such as failure of aero- and hemostasis.

Taking into account the new method of using the implant to eliminate the failure of aero- and hemostasis, which had not been previously performed, the possibility of

using the hemostatic drug Hemoben in the form of a gel for injection into lung tissue was initially studied. At this stage, a technique was developed for the formation of a gel substance from a sterile powder, the viscosity of which would allow the resulting substrate to be productively used for intraparenchymatous injection into lung tissue through an injection needle. This factor is important due to the fact that the resulting gel composition should be easily injected, while the time interval before the final stabilization of the gel should be sufficient to carry out a full-fledged piercing. The next stage of the study was the study of the biological reaction of tissues and the timing of gel resorption in lung tissue, depending on the method of administration and dosages - toxicological studies. This range of research is of fundamental importance for the new techniques created, while the main task is precisely to study the safety of intraparenchymatous use of a gel substance. In this aspect, the evaluation of the effectiveness and duration of aerostasis in ex vivo experiments served as the next stage, after which an in vivo experiment was also conducted to compare these parameters with other types of wound coatings for aerostasis.

According to the results of experimental studies, it was found that the introduction of Hemoben gel into the parenchyma of the damaged lung surface provides a rapid aerostatic effect due to local primary compression on the introduction of the substrate and further swelling of the gel due to the absorption of water from surrounding tissues, while due to elasticity, the implant does not interfere with lung excursion, and persistent aerostasis persists even with maximum pressure increase in the airways.

Morphological studies have found that the introduction of 3.3% Hemoben gel into the lung parenchyma is limited to the zone of alveoli and small bronchioles, thereby does not disrupt local pulmonary ventilation and does not cause a cellular reaction in the form of the formation of giant cells of a foreign body, while the implant is resorbed from 3-5 days without the development of a pronounced inflammatory tissue reaction.

Starting from 2 days after the introduction of the gel into the lung parenchyma, the formation of a surface film is noted directly in the area of damaged tissue, which is dominated by randomly arranged connective tissue fibers with leukocyte infiltration, while the elasticity of the walls of adjacent alveoli is not disturbed, as evidenced by the presence of both areas of preserved airiness and areas of increased airiness, i.e.

emphysematous the alveoli. The formation of this surface film with intraparenchymal gel administration changes the elasticity of the lungs in the area of damage to 3.0± 0.3 g/cm2 (normally 1.0± 0.2 g/cm2), whereas when forming a film from biological glue, this indicator reaches 10.0 ±0.8 g/cm2 (GOST 6806-73).

Toxicological studies have revealed that 3.3% Hemoben gel injected into the lung parenchyma at a dose of 1 ml per 1 g does not have an irritating and toxic effect, and according to spectrophotometric studies, it is completely eliminated from lung tissue within 7-10 days.

Thus, the proposed technique is characterized by the effectiveness and safety of its use, and the results obtained make it possible to apply this method in clinical practice.

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