AN EXPERIMENTAL RABBIT MODEL OF POSTOPERATIVE PERICARDIAL ADHESIONS

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The formation of postoperative adhesions is a serious clinical problem for the present-day cardiac and general surgery. It is characterized by a pronounced abnormal tissue growth caused by the proliferation of fibrous tissues that stick to the nearby normal organs, thus impairing their function and potentially leading to severe clinical complications. In particular, postoperative adhesive pericarditis is a development of abnormal fibrotic attachments between the heart and mediastinum. It significantly complicates multistage surgical corrections of heart conditions, since at each subsequent step the heart needs to be separated from the surrounding adhesions, what extends the duration of the operation as well as increases the risk of injury to the various heart structures during the separation. Also, aortocoronary bypasses are also involved in the process of adhesion formation, which leads to their luminal occlusion and total obstruction over time. In addition to that, adhesion pericarditis reduces myocardial contractility, since the heart becomes attached to mediastinal tissues and as a result the amplitude of its movement decreases [1].

The study of the adhesion formation and the elucidation of its mechanism require a procedure to reliably induce them in a controllable manner. Aside from the investigation of such adhesions, models are used for developing protocols for the treatment and prevention of these postoperative complications. Most experimental models of adhesion formation are based on the simulation of this process in the abdominal cavity [2]. However, the etiology and pathogenesis of the postoperative abdominal and pericardial adhesions are different.

The objective of this study was the development of the experimental animal model of postoperative adhesion pericarditis in order to further assess the efficacy of various strategies for preventing this pathological process.

Five rabbits of the same age weighing 3–4 kg were quarantined for 3 days in the vivarium. They were kept in a 12:12-h light-dark cycle. Food and water were available ad libitum. The rabbits were anesthetized by intramuscular injection of 55 mg/kg of Calypsol (Ketamine) and 5 mg/kg of Xylanit (Xylazine). Mechanical control of ventilation was not required. Chest hair was removed by shaving and the skin was scrubbed with Iodiskin. After left anterior thoracotomy the pericardium was opened longitudinally, an area 2×2 cm was excised and the epicardium of the heart was abraded with a sterile dry swab to develop punctuate bleeding. The pericardium was left open. A pleural drain with a low vacuum drainage system was placed in the thoracic cavity while closing the thoracotomy. Intercostal analgesia was induced by injecting bupivacaine. Postoperative wound was closed in layers of continuous sutures. To prevent infections prophylactic antibiotic (100 mg/kg cefazolin) was injected 1 h before the surgery. After the surgery, cefazolin was administered intramuscularly twice daily for 3 days. Until the rabbits were euthanized, they were observed every day and the wound was cleaned with Iodiskin postoperatively, if necessary. The rabbits were euthanized 4 weeks after the surgery with lethal doses of Thiopental. The heart was excised with its pericardium as a block.

The samples were examined macroscopically by a surgeon, who was blinded with respect to the animal groups. Adhesion formation was evaluated by a macroscopic inspection according to the adhesion rating scale from 0 to 3 proposed by Heydorn et al. [3]. Grade 0 of this scale corresponds to no adhesions, while grade 1 corresponds to adhesions that could be easily dissected by a finger. Moderate adhesions are assigned grade 2, while severe and difficult to dissect adhesions are classified as grade 3. After the implementation of the protocol described above four rabbits of the experimental group had severe grade 3 adhesions, while the remaining one had grade 2 adhesions. Obtained results demonstrate the applicability of this protocol to produce the experimental model of postoperative adhesion pericarditis, which can be used for the comparative assessment of various potential antiadhesive agents.

All experiments were carried in compliance with the recommendations of the European Convention on Humane Treatment of Laboratory Animals [4].

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