THE PREVENTION OF POSTOPERATIVE PERITONEAL ADHESIONS IN A RAT MODEL BY THE NOVEL ANTI-ADHESION POLYSACCHARIDE-BASED FILMS

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Postoperative adhesions are a serious complication often occurring after a variety of surgeries. 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, such as chronic pain, female infertility, bowel obstruction, etc. It also brings huge financial burden to the hospitals and the patient's families. Nowadays, many multiple strategies to prevent and eliminate adhesions have been proposed, but this problem still remains largely unsolved, which stimulates further research of suitable methods and/or materials [1,2].

One of the most promising therapies that prevent the formation of adhesions employs various mechanical barriers. Despite considerable efforts, limited positive results were obtained, which requires further research in this area [3].

In this work, three kinds of films based on the natural polysaccharides blends with different molar ratio of the components were prepared for studying their anti-adhesive properties.

Prior to the study, adult female Wistar rats of the same age weighing 230-270 g were housed at a constant room temperature with a 12 h light and dark cycle. Standard rodent food and water were available ad libitum. Before the inclusion in the study, the animals were kept under observation for 48 hours.

Prior the surgery, fourteen rats were randomly divided into five groups (n=8 in each): the sham group, the control group without any anti-adhesion treatment, and three experimental groups treated with polysaccharide-based film I, II, and III, respectively. Then all the rats were anesthetized by intraperitoneal injection of 300 mg/kg of Chloral hydrate and 1 mg/kg of Xylazine. In all animals, after shaving and sanitizing, a 3-cm long median laparotomy was performed. In the sham group animals underwent only laparotomy without any injury and/or suturing. In the other experimental groups, the cecum was delivered and the cecum wall was injured by 1 minute application of a cotton pad soaked in an alkaline (1 N sodium hydroxide) solution. Then the cecum was thoroughly washed with saline water. In the experimental groups, the investigated anti-adhesion films were trimmed into pieces 2×2 cm and then applied in-between the abdominal wall and the injured cecum. The cecum was put back into the abdominal cavity and fixed to the abdominal wall by a non-absorbable suture. The abdomen was closed using two-layer closure technique by a consecutive suture. To prevent infections prophylactic antibiotic (50 mg/kg Tylosin) was injected intraperitoneally after the surgery. Also, the same antibiotic was administered intraperitoneally once daily for 4 days. Until the rats were euthanized, they were observed every day and the postoperative wound was cleaned with ethanol, if necessary.

At day 14 after surgery, the animals were euthanized with lethal doses of Chloral hydrate. The abdominal cavity was opened via a U-shaped incision. The severity and the area of adhesions between the cecum and abdominal wall 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 5 proposed by Oncel et al. [4]. Grade 0: no adhesions; grade 1: loose filmy adhesions that can be separated by blunt dissection; grade 2: adhesions requiring <50% of sharp dissection for separation; grade 3: adhesions requiring >50% of sharp dissection for separation; grade 4: serosal injury, grade 5: full-thickness injury.

In the sham group (without prior adhesion-induced operation), six animals had no adhesions, while the other two had grade 2 adhesions. Severe grade of adhesion for the control group was 4.4. The animals treated with implanted film I had severe grade 1.6 adhesions. In the group treated by film II, the severe adhesion grade was 1.21, while in the third treated group the adhesion grade was 1.20. The overall significantly lower severity grade in the groups, where studied polysaccharide-based films were applied, points to the effectiveness of the chosen approach and materials for reducing the formation of tissue adhesion.

Obtained results demonstrated that the novel polysaccharide-based films were effective in reducing the formation of tissue adhesion.

All experiments were carried in compliance with the recommendations of the European Convention on Humane Treatment of Laboratory Animals [5].

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