INVESTIGATION OF HEMOSTATIC ACTIVITY OF POLYMERS WITH IMMOBILIZED ACTIVE CHLORINE

Yarovyi Volodymyr
graduate of the 1st medical faculty
Dnipro State Medical University, Ukraine

Supervisor: Murashevych Bohdan
Ph.D., Associate Professor of Biochemistry Department
Dnipro State Medical University, Ukraine

The synthesis of polymeric materials with antimicrobial activity for biomedical applications is one of the trends in modern chemistry of macromolecular compounds. Such materials are widely used as raw for the manufacturing of special clothing, implants, catheters, protective masks, wound dressings, etc.

Previously we have synthesized N-chlorosulfonamides of various structures, immobilized on copolymers of divinylbenzene and polystyrene grafted to polyethylene. It has been proven that upon contact with a medium containing amine compounds (including contaminants of biological origin) such materials release an equivalent amount of active chlorine, exhibiting a powerful microbiocidal effect [1]. Thus, they potentially can be used as an active component of antiseptic dressings with prolonged action. It was interesting to study the hemostatic activity of such polymers.

Hemostatic activity has been studied in vivo on 25 mature Wistar rats using the method [2]. For this, the rats under ether anesthesia underwent a medial laparotomy. One of the lobes of the liver and the pole of the spleen were alternately withdrawn into the operating wound. After hemostasis of the wound edges and its delimitation with a plastic film, a dry sterile napkin with a known mass was placed under the intended area of organ injury. The liver wound was inflicted to one of its lobes by tangential cutting off the edge in such a way that the length of the wound was 1 cm and the depth was 0.5 cm. The spleen wound was simulated similarly (length 0.5 cm, depth 0.3 cm). After resection of a part of the liver and spleen, capillary-parenchymal bleeding started. The study material was immediately applied to the wound area. As a control, the polymer with sulfonamide groups without active chlorine was used, as well as the gauze pad (separately). Simultaneously with the wounding, a countdown was started to record the duration of bleeding, which was carried out until the termination of the release of blood from under the application material. The amount of blood loss was measured by the difference in the weight of a sterile dry dressing placed under the injury area before surgery and after it was soaked in blood during the experiment.
It was found that the application of the studied polymers with active chlorine significantly reduced the duration of bleeding in comparison with gauze: by 54% at a concentration of active chlorine in the material of 6% and by 43% at a concentration of 9%. Also, on average, the amount of blood loss is reduced by 18-21%. When using a polymer without active chlorine, these indicators also decrease, but to a lesser extent (by 22% and 10%, respectively). It was also noted that the hemostatic properties of studied polymers are directly proportional to the concentration of immobilized active chlorine, although it is known that solutions of active chlorine, for example, sodium hypochlorite, are, on the contrary, hemolytics for capillary bleeding.

Thus, the synthesized materials have a pronounced hemostatic effect, which, along with the previously proven antimicrobial properties, makes them extremely promising for use as a components of wound dressings.

References: