EVALUATION OF TITANIUM AQUACOMPLEXGLITSEROSOLVATE AND OXYTOCIN IN THE TREATMENT OF SOFT TISSUE WOUNDS IN EXPERIMENT

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In the context of the above properties of titaniumaquacomplexglycerosolvate and oxytocin we have studied their joint application in order to increase the efficiency of treatment of soft tissue wounds. In the investigation performed, 144 experimental animals (white rats) with simulated aseptic wounds were studied. This study will contribute to develop a new treatment for soft tissue wounds, based on the application of aquaglitserosolvatetitanium and oxytocin, examine and assess the effectiveness of aquaglitserosolvatetitanium and oxytocin in the treatment of experimental soft tissue wounds. To assess the process of wound healing in the experiment, methods of clinical, planimetric progressive examinations of wounds, as well as strength characteristics of the scar formed were used. One of the objective measures of wound healing is the study of changes in the area in the healing process. The wound area was calculated by the method of L. N. Popovoy (1942). On the basis of clinical and planimetric methods of investigation, it was found that the decrease in the wound area is significantly faster under the influence of oxytocin and titanium aquacomplexglycerosolvate.

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Introduction

The problem of treating wounds is one of the most important in surgery, being relevant to healthcare, because the outcome of wound healing and the patient's work capacity depend on the effectiveness of its solution (Kuzin & Kostyuchenok, 1990; Datsenko, 1995; Adamyan & Glyantsev, 1992; Davydov & Larichev, 1999; Gostischev, 2003).

Over the years, the urgency of the problem has not merely decreased, but, on the contrary, is becoming increasingly important due to changes in the biological properties of the wound microflora and human immune reactivity (Gostischev, 1996; Bazhenov, 1997; Datsenko et al., 1991).

Many methods of regional therapy of this disease have been already proposed: laser therapy, ultrasound, and Electro-jet fabric processing; sorption therapy, ozone therapy, vacuum, use of various biological materials, nanotechnology, and a number of others that have substantially improved the effectiveness of treatment. (Gryaznov & Cherednikov, 1990; Kostyuchenok, 1984; Bulynin, 1995; Omorov, 2003; Gluhov & Abakumov, 2008; Hartel, 2006).

At the same time, the data available suggest that many methods have certain disadvantages: side effects, lack of effectiveness, the narrow focus of the impact, the technical complexity of the application, etc. In this regard, the need for further research in the field of development of new effective and affordable ways of treating soft tissue wounds persists (Kurbangaleev, 1985; Miroshin, 1995; Kuznetsov, 1984; Chiang, 2007; Scardino, 1998; Bayat, 2006; Gluhov, 1996).

Significant progress in the treatment of wounds is associated with the introduction of high-efficiency general and local medications into clinical practice. One of them is a metal complex compound of titaniumaquacomplexglycerosolvate, which has anti-inflammatory effect, and the presence of bound molecules of glycerol and titanium atom provides a protective, dehydrating, antiedemic and local analgesic effect. On the basis of studies conducted, it is found that the biological effect of titaniumaquacomplexglycerosolvate as an independent medication can be improved through an integrated application (Smagina & Beketov, 2006).

At present, oxytocin, which is a hypothalamic nonapeptide, is also used in the treatment of wounds. Oxytocin use in clinical practice has been based on its antimicrobial and immunotropic properties as well as on the ability to positively influence the repair of tissues of different origin (Bukharin et al., 1982; Kurlaev et al., 2010). The efficiency of oxytocin in combination with antibiotics in the complex treatment of pyelonephritis, operated ear diseases and inflammatory diseases of soft tissues has been proven (Kurlaev et al., 2010). Local application of combinations of antibiotics with oxytocin significantly improved outcomes in patients with purulent-inflammatory diseases of soft tissues, with acute purulent diseases of lungs and pleura, with purulent sinusitis, in abdominal sepsis in the experiment (Kuzin, 1990). Analgesic properties of this hormone were discovered as early as in the 1970s (Bukharin, 1982).

Materials and methods

Simulation of aseptic wounds in a pilot study was conducted using a modified method of Sychennikov (1980). In all groups of animals under anesthesia ("Zolitil-100" in a dose of 8 mg / kg / according to the manufacturer /), on a shaven clean area of the outer surface of the middle section of the thigh, a linear incision of the skin, subcutaneous fat, fascia and muscle, length of 1.0 cm, was made with a medical disposable scalpel. Treatment started immediately after wound the simulation.

Experimental study was designed to study the effect of titaniumaquacomplexglycerosolvate and oxytocin on reparative processes in aseptic wounds of soft tissues. In the experiment (144 animals) the effect of titaniumaquacomplexglycerosolvate during wound healing in aseptic wounds was studied. Three groups of animals were distinguished: three experimental groups and a control one. Each group had 36 animals. In the experimental group I, aseptic treatment of wounds consisted in the application of titaniumaquacomplexglycerosolvate on the wound with a gauze pack. In the experimental group II, treatment of a simulated aseptic wound was carried out by means of introducing a single dose of 0.5 ml of oxytocin in the wound.

In the experimental group III, wounds were treated by the joint use of titaniumaquacomplexglycerosolvate and oxytocin: the wound was treated by a titaniumaquacomplexglycerosolvate applied to the gauze pack, and then the wound was injected with 0.5 ml of oxytocin. Treatment of animals of experimental groups was carried out once a day every day and began immediately after the wound simulation. In the control group, the animals were left untreated.

Results and discussion

To assess the process of wound healing in the experiment, methods of clinical, planimetric progressive examinations of wounds, as well as strength characteristics of the scar formed were used.

One of the objective measures of wound healing is the study of changes in the area in the healing process. The wound area was calculated by the method of Popovoy (1942). A sterile transparent film was applied to the wound and the contour of the wound was drawn after that. The pattern obtained was transferred onto graph paper and the wound area in square millimeters was counted.

Percentage of wound area reduction per day is given by:

$$S = \frac{S - S_n}{S.t}.100\ [\%],$$

where: S – wound area at the previous measurement; S_n – wound area at a current measurement; t – Number of days between measurements.

To study the dynamics of aseptic wound healing with the use of oxytocin and titaniumaquacomplexglycerosolvate, clinical and planimetric characteristics were monitored. Progressive evaluation of clinical features of the course of wound healing in the groups investigated proved impossible, since by the 1st day after the experiment, only 20% of the experimental animals in the control group remained ill-defined swelling and diastasis of the wound edges. By the 2nd day from the date of modeling, the wounds showed no visual difference from each other in all groups of animals: any signs of swelling and redness, while healing process was under the film of scab.

The average wound area before treatment was 48.77 ± 0.07 mm 2 ($p < 0.05$). By the 1st day, the most significant decrease was noted in the wound area of experimental group III, in which oxytocin was used and titaniumaquacomplexglycerosolvate was applied. The rapid decrease of the wound area (26.29-38.38%) takes place during the first day, because after its application, its aseptic conditions of modeling experimental wounds and its relatively small size contributed to the consolidation of the wound edges, as well as due the joint use of drugs.

Test groups I and II of animals (20.46%) showed slightly less marked improvement in wound healing process, compared to the experimental group III. Slow reduction of wound area in the control group (16.29%) was associated with no treatment provided, which resulted in a swelling, so close-up of wound wedges was inhibited by the subcutaneous fat and muscles, as well as persistent serosanguineous discharge.

In the control group, the wound area from the 1st till the 3rd day was reduced by 57.98%. During the same time period, the experimental group I showed decrease in wound area of 53.69%, the experimental group II - 55.53%, the experimental group III - 45.69%. Based on the absolute values, we could note that by the 3rd day of the experiment the wound area was the smallest in 3rd experimental group.

From the 3rd till the 5th day, an average decrease in wound area in the experimental group I was 62.85%, in the experimental group II - 61.08%, in the experimental group III - 68.96% ($p < 0.05$) and in the control group - 55.12%. The findings obtained prove a high efficiency of titaniumaquacomplexglycerosolvate and oxytocin at the period specified.

From the 5th till the 7th day, due to the beginning of regenerative phase of healing, the rate of wound area reduction averaged 65.12%; however, significant difference in the rate of decrease in this index in the groups investigated was not registered.

By the 7th day of the experiment the smallest wound area was registered in animals of the experimental group III and was 1.38 ± 0.24 mm 2 ($p < 0.05$). In the experimental group I, in which the titaniumaquacomplexglycerosolvate was used, the wound area was 3.1 ± 0.73 mm2, in the experimental group II – 3.3 ± 0.53 mm2 and in the control group – 4.05 ± 0.65 mm2.

Conclusion

Analyzing the results of experimental studies, it can be concluded that the most effective in the treatment of aseptic wound is the combined use of titaniumaquacomplexglycerosolvate and oxytocin. Thus, on the basis of clinical and planimetric methods of investigation, it was found that oxytocin and titaniumaquacomplexglycerosolvate significantly speed up the wound healing process, namely a reduction in the wound area.

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