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Complex Treatment Of Purulent Wounds In Experimental Rats: New Promising Approaches

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Abstract. Study of the effect of the new drug Reomannisol on endogenous intoxication and wound healing, taking morphological aspects into the complex treatment of experimental diabetic foot syndrome.
Keywords: Diabetes mellitus

Relevance: Diabetes mellitus and its complications remain an urgent problem of modern surgery. Therefore, it is important for surgeons to create new stages in the treatment of diabetic foot syndrome and restore their ability to work and improve the quality of life in relation to patients. An assessment of the effectiveness of a new biological preparation is shown.

Purpose: Study of the effect of the new drug Reomannisol on endogenous intoxication and wound healing, taking morphological aspects into the complex treatment of experimental diabetic foot syndrome.

Materials and research methods: Experimental studies were conducted on 155 white mongrel male rats weighing 150-200 g, kept in the TMA vivarium. The rats were kept in optimal conditions, all rats were kept in a room with a 24-hour light-dark period and a constant temperature of 22-25 °C, with free access to water. Animals in sufficient numbers received a standard diet for rodents ad libitum (diet for rodents, GOST R50258-92). Before the animals were introduced into the experiment, they were quarantined for 1 month. The experimental group consisted of 155 rats, and the intact group consisted of 10 rats. The animals of the experimental group were weighed after 24 hours of fasting, and a 2% solution of alloxan diluted in 0.9% physiological water by the body weight of rats was injected once into the abdominal cavity in appropriate doses: 12, 15, 18 and 20 mg/100 g, water was given 20 minutes after administration of the drug. The development of diabetes was assessed by the level of glucose in the blood and the morphology of the beta cells of the pancreas. In series 1, 10 rats were used that had a so-called diabetes model. To do this, 2% alloxan in the amount of 20 mg/100 g was injected into the abdominal cavity of 10 rats. In this experimental group, 7 rats died within the first 4 days as a result of hyperglycemic and hypoglycemic coma, which amounted to 70%. In the second series, 10 rats were injected with alloxan at a dose of 18 mg/100 g to create an experimental model of diabetes. In this series of experiments, mortality in the first 3 days was 50% (5 rats). In the 3rd series of the experiment, 155 rats were used, of which 10 were an intact group, and the remaining 145 rats were caused by a diabetic foot model on the background of alloxan diabetes. Alloxan in this group was administered intraperitoneally at a dose of 12 mg/100 g. During the next 72 hours, no fatal outcome was observed in the rats, the blood glucose level in the rats ranged from 13,5 – 15,5 mmol/l. An experimental DM 1-type model has been created. After general anesthesia, after intraperitoneal administration of sodium thiopental at a dose of 80 mg/g relative to the body weight of each rat, the experimental animal A.I.Sechenov was on the table with his stomach. The back of the rat's hind legs (only one of the left or right hind legs is selected) is treated with an antiseptic and injected under the skin of the leg using an insulin syringe of 0,25 ml of 10% calcium chloride solution ($CaCl_2$). Before this manipulation, 20,0 ml of saline solution is poured into a Petri dish, into which 6-7 feces of the same rat are thrown. After the stool swells, it is crushed to form a suspension. The resulting solution is passed through a gauze napkin (the reason is so that during injection, fiber and tissue detritus of feces do not get into the syringe needle and become clogged). 1 ml is taken from the finished suspension and injected subcutaneously into the injection site of calcium chloride. And after 72 hours, we open the purulent-necrotic wound, and you can see its condition. The experimental animals were divided into 4 groups: group 1 – unchanged group (intact); Group 2 – the creation of an experimental model of alloxan diabetes; control group 3 - carrying out traditional complex therapy (monotherapy + Reosorbilact) against the background of the creation of an experimental model of the diabetic foot; experimental group 4 - on an experimental model of diabetic foot is the implementation of traditional complex therapy treatment and ozone therapy + Reomannisol.

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Results: In the rats of the control group, there was a tendency to decrease the body weight of rats compared with the values of intact animals. Diuresis increased, and polydipsia persisted, on the 10th and 14th days of the experiment it significantly exceeded the values in intact rats by 4.15 (P<0.001); 3.39 (P<0.001) and 3.57 (P<0.001) times; 3.12 (P<0.001) times. In the comparison group (Ozonotherapy + Reosorbylact), no weight loss was observed, by the end of the experiment, the indicators of polyuria and polydipsia began to gradually decrease: on day 14, the indicators of polyuria and polydipsia decreased by 2.39 (p<0.001) and 2.38 (p<0.001) times compared with the values of the control group, but still higher than in an intact group. No weight loss was observed in diabetic purulent-necrotic foot rats (the main group) receiving detoxification therapy with Ozonotherapy + Reomannisol. On the 14th day of the experiment, the indicators of polyuria and polydipsia were significantly lower than in the comparison group, by 1.44 (P<0.05) and 1.47 (P<0.05) times. By the end date, they did not differ significantly from the intact rats. Modeling of diabetes has led to significant changes in basic biochemical parameters. As can be seen from Figure 1, on the 1st day of the creation of the diabetic foot model, the glucose level in the blood serum of rats increased statistically significantly by 2,86 times compared with the intact group of rats and amounted to 17,1 ± 0,29 mmol/l (P<0,001) (in the intact group – 4,3±0,19 mmol/l). In later periods, the blood glucose level in rats with diabetic purulent-necrotic foot tended to decrease, but was also high on day 14, which was 2,21 (P<0,001) times higher than in intact rats and amounted to 13,3±0,19 mmol/l. A gradual decrease in glycemia levels was observed in the main group (Ozonotherapy + Reomannisol). On days 7, 10, and 14, experimental animals showed 1,57; 1.89, and 1,94 (P<0,001) drops in blood glucose levels compared to the control group. For this reason, the components of Reomannisol have a positive effect on pancreatic microcirculation and blood rheology, helping to increase the interactor function of the pancreas. The main indicators of the final products of nitrogen metabolism are the amount of urea and creatinine in the blood serum. In this regard, a study showed an increase in urea and creatinine levels in diabetic foot rats (Group 3), a statistically significant increase compared to intact rats. In our opinion, such a progressive increase in the level of urea and creatinine in blood serum is associated with an increase in the catabolism of proteins and amino acids and their use for gluconeogenesis from nitrogen-free residues. In later periods, serum urea and creatinine levels gradually decreased in all groups, but in the control group, urea and creatinine significantly increased by 2.51; 2.39; 1.9 (P<0.001), and 2.07 (P<0.001) times compared to rats that are still intact. 1.84 (P<0.001) and 1.57 (P<0.001) times, respectively, on days 7, 10 and 14 of the experiment. In the comparison group on the 10th and 14th days of the experiment, these rates are significantly higher than the values of intact rats at 1.37; 1.2 (P<0.001) times and 1.35; 1.17 (P<0.001) times. The results obtained show good detoxification properties of the drug Reosorbylact. In the main group (Ozonotherapy + Reomannisol) on Day 10, these rates tended to exceed norm values by 1.14 and 1.12 (P<0.001) Times, which by the end of the experiment were not significantly different from the unbroken group indicators. The results obtained indicate that the detoxifying properties of the drug Reomannisol are higher than those of Reosorbylact. In diabetes mellitus, an increase in POL is observed, especially in the diabetic purulent-necrotic feet. On Day 1 of the experiment, the MDA level exceeded the standard values. By the 3rd day of the experiment, the intensity of the POL had increased even more. Subsequently, we observed that it was gradually decreasing, despite such positive changes, on the 7th, 10th, and 14th days of the experiment, the amount of MDA in blood serum increased by 1.46; 1.4 and 1.34 (P<0.001) martagasezilar from the indicators of intact rats (Figure 2).

Conclusions: The rate of healing of wound defects in rats with diabetic foot syndrome in the control group falls on the 14th day since the terms of resorption and rejection of necrotic tissues in the wound are lengthened, damage to the vessels of the microvasculature (microangiopathy), edema is observed for a long time. The wounding process against the background of DM is characterized by the late formation of angiogenesis, slowing down and impaired maturation of granulation tissue, and marginal epithelialization. In the experimental group, in rats, along with the local traditional method of wound treatment, the drug Reomannisol was used intraperitoneally, as a result, wound healing was recorded on the 10th day from the moment the wound was applied to the foot of the rats. The use of local treatment and Reomannisol can enhance angiogenesis in the early stages of the experiment and restore disturbed microcirculation (neoplasms of blood vessels), increase macrophage response, fibroblast proliferation, maturation and remodeling of granulation tissue and its epithelization, reduce the inflammatory reaction, which leads to more effective and early healing wound area.

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