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INDICATORS OF REPERATIVE REGENERATION OF CHITOZAN IN THERMAL BURNS.

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Abstract:

Background: The treatment of burns is the most important biological, medical and social problem and remains relevant to this day. The modern approach to the development of dressings is to abandon the general means used for the whole period and to move to a handkerchief specifically designed for use at one stage or another, depending on the specific clinical situation.
Aim of the study: The aim of this study is to evaluate the effect of chitosan gel products on grade epithelialization rate, regeneration coefficient and morphology in grade 3th skin burns.
Materials and methods: The burn was caused by immersing the depilated lumbar region in boiling water for 10s, the wound area was 18-20cm^2 (18-20%). The mortality rate in the study was 13.6% uninjured animal skin was used as a control
Results: The highest proliferative activity was observed in the animals of group 1, in which the regenerative properties of the drug were preserved for a long time. In groups 2 and 3, the repair processes were slower, as the completion rate and regeneration coefficient were somewhat lagging behind. Their lowest scores were recorded in group 4.
Conclusions: The natural polysaccharide chitosan and its derivatives activate fibroblast proliferation and normalize skin regeneration. On the other hand, chitin derivatives are structurally similar to skin glucosamine and serve as a basis for keratinocyte and fibroblast growth.

Keywords: Regeneration, Chitosan, Thermal Burn, Velocity Epithelization, Modeling Of The Burn, Wound Healing.

INTRODUCTION

Currently, a number of scientific studies are being inducted in the world of medicine, especially drugs used in combustiology, aimed at activating the reparative regeneration of the epithelium in the lesion (1,2). In this regard, the study of replication, transcription and intercellular interactions and development of drugs that activate these processes are relevant. In the implementation of these processes, effect of epidermal growth factor is significant, and their activity on undamaged cells in the burn center leads to the epithelialization of furnace. However, the mechanisms allow the development of local drugs that activate the reparative processes (2).

The natural polysaccharide chitosan and its derivatives activate fibroblast proliferation and normalize skin regeneration. On the other hand. Chitin derivatives are structurally similar to skin glucosamines and serve as the basis for the growth of keratinocytes and fibroblasts.

The aim was to evaluate the effect of chitosan gel products on grade epithelialization rate, regeneration coefficient and morphology in grade 3th skin burns.

MATERIALS AND METHODS

Experiments weight 140-160 g a total of 120 non-breeding male rats were kept, which were kept under standard feeding conditions. The experiments were conducted in accordance with the European Convention for the Protection of Vertebrates for Experimental and the scientific propose (3,4).

The burn was caused by immersing the depilated lumbar region in boiling water for 10s, the wound area was 18-20cm^2 (18-20%) (1). The mortality rate in the study was 13.6% uninjured animal skin was used as a control.

Two hours after thermal injury, the rats were divided into four groups: group 1 (25 rats) – chitosan (Cs), 2% acetic acid, glutaraldehyde (GA), and furatsilin (Fs) group 2 (25 rats) – chitosan (Cs), 2% acetic acid, glutaraldehyde (GA): group 3 (25 rats) – chloramphenicol ("Nijfarm"); group 4 (25 rats) – treated with saline (placebo). Intact rats were left in the fifth group. After two hours, the injured lesion was washed with hydrogen peroxide and drugs were applied once, in the form of local ointment to the wound site, a dose of 1 mg/kg body weight. The regeneration rate was determined using the regeneration coefficient indicator (5,6).

$K=S_1/S_2$

In this case, the K-regeneration coefficient

S_1 is the initial indicator of the injured surface area

S_2 is the next indicator of the injured surface area

To measure the aera of the injured surface, a sterile, thin polyethylene film is placed on the affected area of the skin, the contour of the wound surface is drawn with a marker, cut, scanned on a computer, and the surface is identified using a program (7,8). The regeneration coefficient was measured on days 3, 7, and 10 after treatment.

Studies were performed on days 3, 7, and 10 of treatment. Six to seven animals from each group were decapitated under light ether anesthesia and blood and part of the damaged skin were taken from them for analysis.

RESULTS

Results of effective Cs+Fs exposure in experimental burn lesions are presented. In the first day after the burn injury, the rats showed signs of acute burns: weakness, adynamic, shortness of breath, polydipsia and polyuria. On the third day a necrotic layer was formed in the upper part of the wound. In group 1 during the treatment, the condition of the experimental animals slightly normalized, their activity and appetite improved. Similar results were observed in groups 2 and 3, but signs of intoxication were still present. In-group 4, symptoms of intoxication persisted for a long time, the general condition of the animals deteriorated, signs of purulent-septic inflammation appeared. In the control group, infectious inflammation of the wound area with the formation of ulcers was observed. Over time, the wound area expanded 1.3-1.5-fold, and signs of necrosis appeared. In the rats of the 1st and 2nd groups a gradual recovery process began under the frozen layer of the wound, no inflammation spreading was observed, and in the animals of the 3rd group the signs of inflammation persisted. Analysis of the wound area wrinkling in the studied groups showed a strong manifestation in the 1st group.

DISCUSSION

In groups 2 and 3, the drugs had the same effect, while group 4 showed a slower recovery than the other groups. We also observed the dynamics of the wound healing rate. In particular, the wound area in the 1st group ranged from 14,08±0,66 cm^2 to 9,47±0,41 cm^2 at the 10th day, and in the 2nd group from 13,26±0,65 cm^2 to 10,90±0.52 cm^2 decreased, and in groups 3 and 4 the figure remained the same.

The highest proliferative activity was observed in the animals of group 1, in which the regenerative properties of the drug were preserved for a long time. On the 3rd and 7th days this index was 4,5 (P<0,001) and 4 (P<0,001) times higher than in the control group; were 2,5 (P<0,05) and 1,4 (P<0,05) higher than in the comparison group. In group 1 animals, the wound healing rate increased sharply on days 3 and 7 with a slight decrease by day 10. The rate of maturation was 3-5 (P<0.001) times higher on day 3 compared to the control group and 4 (P<0.001) times higher on day 7. This was also proved in the analysis of the regeneration coefficient. Especially in animals of group 1 this index was higher. In groups 2 and 3, the repair processes were slower, as the completion rate and regeneration coefficient were somewhat lagging behind. Their lowest scores were recorded in group 4.

Morphological study of spontaneous healing of burn injury (group 4) revealed the formation of coagulation necrosis of epidermis and dermis, fragmentation of collagen fibers, necrosis of epidermis, desquamation of its horny and granulation layers, and such changes persisted for 10 days. Group 1 animals showed early regeneration of the injured focus, as well as formation of newly formed granulation tissue and blood vessels in all layers of the dermis, which testified to the fact that skin regeneration was going perfectly. Group 2 animals also revealed accelerated epithelial regeneration, cell differentiation and strong vascularization in some parts of the basal layer. When levomecol was applied topically, the lesion was weaker than in groups 1 and 2, infiltration of lymphocytes, leukocytes, histiocytes under epidermis was detected. on day 10 of the experiment, focal peeling with active regeneration of skin layers was also observed.

CONCLUSIONS

Thus, in skin burns, chitosan gel, especially with the addition of Fc, increased the rate and coefficient of regeneration in the affected area, leading to the healing of the damaged skin surface. It is possible that Fc in the composition of the preparation has a bactericidal bactericide effect, accelerating regeneration due to early removal of pus from the wound. According to some scientists, the enhancement of reparative regeneration under the influence of chitosan in undamaged cells may be due to the densification of DNA molecule in the nucleus by chitosan. The natural polysaccharide chitosan and its derivatives activate fibroblast proliferation and normalize skin regeneration. On the

other hand, chitin derivatives are structurally similar to skin glucosamine and serve as a basis for keratinocyte and fibroblast growth.

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