

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Peculiarities of Wound Process at the Regional Application of Titanium Aqua-complex Glycerosolvate and Oxytocin in Experiment.

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ABSTRACT

Wound treatment is one of the toughest problems in surgery. The prospective way of wound treatment is the use of gel medication, which consists of different chemical components having passive adsorptive and active antiseptic properties. To study the effective use of titanium aqua-complex glycerosolvate and oxytocin application in aseptic soft tissue wound treatment. The research was done on 144 white rats. Depending on the type of regional treatment (use of aqua-complex titanium glycerol solvate, oxytocin, or their combination), the rats were divided into groups: one control group and three experimental groups. The study of the peculiarity of the wound process was accomplished by macroscopic, plan-metric, histological, statistical research methods. The data obtained through the experiment demonstrate an evident influence of titanium aqua-complex glycerosolvate and oxytocin regional application on the reparative processes of aseptic wounds. The rating of positive impact is as follows: oxytocin injection (11%) < instillation of titanium aqua-complex glycerosolvate (ATG) (14%) < combined application (32%). Analyzing the results of the current research, we can conclude on a statistically reasonable basis that investigated methods of treatment have evident mechanisms of action, representing evident activation of the total reparative process and epithelial structure differentiation that close wound defect. In the case of monotherapy, oxytocin injection has a moderate positive effect on wound process, while the instillation of titanium aqua-complex glycerosolvate has a medium positive effect. Combined application of the above-mentioned methods has the greatest effect on the early activation of the reparative process.

Keywords: wound process, titanium aqua-complex glycerosolvate, and oxytocin.

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INTRODUCTION

Wound processes are one of the global problems of surgery. Firstly, this is due to the damage of the tissue covering has accompanied human existence throughout his evolution development; Secondly, even with significant advances in the medical science industry, the problem of therapeutic effects on wound problem optimization of their treatment is not completely researched at this present of time [1, 13]. This necessitates continued development of advanced technologies treatment of cancer through creating new or optimizing the existing methods [2, 3, 6-9, 14-16].

Promising is the use in treating complex wounds gel medications consisting of different chemical composition - having a passive adsorption and active antiseptic property [2, 3, 9, 10, 11, 14]. In particular, due to its physicochemical characteristics, pathologic interest is an innovative gel product based on titanium aqua-complex glycerosolvate [11]. Relatively new in treating wound processes is the method of injecting oxytocin, which stimulates the local properties of reparative processes [4, 5]. However, a number of issues, relating to the use of these drugs in the treatment of wounds, requires further study.

The purpose of the study – to study the effectiveness of titanium aqua-complex glycerosolvate and oxytocin in the experimental treatment of aseptic experimental soft tissue wounds.

MATERIALS AND METHODS

The experiment was done at the SRI base of experimental biology and medicine Voronezh State Medical University named N.N. Burdenko on 144 white rats (Table. 1). The rats were standardized for age and body weight (300,125 g). The study investigates the impact of titanium aqua-complex glycerosolvate and oxytocin wound on aseptic processes. The experiment consisted of four groups (one control and three experimental) of 36 animals in each group.

In the experiment, we inserted the wound according to the procedure by Sychentgikova A.I. (1974). On the outer surface of the upper 1/3 of the thigh was performed linear incision 1.0 cm long of the skin, subcutaneous adipose, fascia, and muscle. After removing the animals from the experiment, they underwent treatment and taken back in the vivarium.

We studied the characteristics of the injured process as follows: dynamic study condition of the wound (edema, hyperemia, painful palpation, appearance of granulation, epithelization); the duration of the period of wound healing and relative enforcement and decreased injured surface (by the method Popova LN, 1942); the use of histological (hematoxylin-eosin, Van lawns) and histochemical methods. The histochemical assessment using cytophotometry was used to assess the effect of the studied techniques to intensify basic molecular mechanisms underlying the reparative regeneration. This assessment is based on a two-composed microphotometric assessment of the growth layer. These components are indicators of the concentration of RNA according to S. Shea's azure method and IDevremona and Frederick's SH-group method (1943). RNA content and SH groups in the cells epidemical growth layer of the wound defect were assessed according to quantity using Leica image analyzer Qwip Standard V2.6 (Leica, Germany), which consists of a Leica DRM microscope, a Digital Camera «Leica OS 300 F», a personal computer with the software Leica Q 550 W.

For the individual selection of objects in the image, we used a mode discriminatory signal level with the adjustment of a binary image editor and filters.

Interpretation of the results of the dynamical cytophotometric indicators of RNA and SH groups: the start of the activation of reparative processes was considered on-stage observation (day), in which we observed increased optical density significantly higher than initial or secondary physiological values.

Table 1

Structure of the experiment

Group	n	Characteristics of the research groups
Control (K)	36	Without treatment

1 st experimental (O1)	36	Gel sorbent instillation
2 nd experimental(O2)	36	Oxytocin injection
3 rd experimental (O3)	36	Gel sorbent instillation, oxytocin injection

All studies were conducted with the strict observance of the requirements set out in the following documents: "Convention for the Protection of vertebral animals used for experiments and other purposes" (Strasbourg, France, 1986); "Rules of the laboratory practices of the Russian Federation" (by order of the MH RF № 267 of 19.06.2003) and the Ministry of Health of the USSR Order № 755 from 08.12.1977 "On measures for further perfection of the work with laboratory animals."

Statistical analysis of the results was based on the evaluation of the nature of the distribution values of the studied parameters in the experimental groups followed by evaluation of the level of statistical significance of the differences between the groups. The nature of the distribution of values of the studied parameters was assessed using the W-test By Shapiro- Wilk. The level of statistical significance between group differences in the values of the distribution according to the normal distribution was assessed using a parametric T-test Student for unrelated samples, Mann-Whitney-U test for non-compliant samples. To avoid multiple analysis observations (simultaneous comparison of three or more groups), we used parametric univariate dispersion analysis ANOVA (when the normal distribution of the test featured in all compared groups) or non-parametric one-factor analysis of Kruskal-Woliss (when the normal distribution of the test was not featured in any group). For posterior comparison groups (i.e. detection out of the groups, pairs that significantly differ from the others), the Scheffe test was applied. Inter- group differences were considered reliable only when the probability no errors was at 95 % or more (i.e. a minimum level of difference in statistical significance $p < 0,05$). Technically, all the statistical processing and review of the results was done using a personalized Asus computer Intel® Core™ 2 Quad CPU Q 9550 @ 2,83 Gb 2,00 GB OZU with Microsoft Windows® XP Professional Service Pack 3 version 5.1 with the StatsoftStatistica 6.0 program.

RESULTS AND DISCUSSION

For the duration of the aseptic process that went without therapeutic effects, the end of the epithelization occurred around the 7.6 ± 0.84 th day. For the same duration using instillation of titanium aqua-complex glycerosolvate, epithelization occurred around the 5.16 ± 0.73 rd day. The duration of this process by injecting oxytocin- occurred on the 6.37 ± 0.64 th day, while a combined treatment using titanium aqua-complex glycerosolvate and oxytocin occurred on the 5.11 ± 0.56 th day. The acquired results show the undeniable effectiveness of the combined application of titanium aqua-complex glycerosolvate and oxytocin in the healing process for aseptic wounds.

As for the intact duration of the aseptic process of the wound that went without medical effects, the relative decrease in the surface of the injury for the first 4 days was at $64.85 \pm 17.15\%$. In the experimental group 1 the same process was composed of $- 77.9 \pm 19.3\%$ (intergroup difference in comparison with the control group was 14% ; $p = 0.030421$), in the second experimental $- 71.9 \pm 18.4\%$ (intergroup difference in comparison with the control group $- 11\%$; $p = 0.030281$), in the third experimental $- 85.49 \pm 19.1\%$ (intergroup difference in comparison with the control group $- 32\%$; $p = 0.034372$).

The duration of the wound-healing period of the aseptic process that occurred without therapeutic effects (control group), was 7.6 ± 0.84 days. In the first experimental group $- 6.16 \pm 0.73$ days (intergroup difference when compared to the control group $- 12\%$; $p = 0.030311$). In the second experimental group $- 6.37 \pm 0.64$ d. (Intergroup difference compared with the control group $- 9\%$; $p = 0.040221$). In the third experimental group $- 5.11 \pm 0.56$ days (Inter-group difference compared with the control group- 27% ($p = 0.023731$)).

The acquired results testify to a great influence of titanium aqua-complex glycerosolvate and oxytocin on the reactivation preparative processes of the aseptic wound in hydration phase. The rating of the positive influence of this method is as follows: injection oxytocin- $11\% <$ titanium aqua-complex glycerosolvate instillation $-14\% <$ combined use of oxytocin and titanium aqua-complex glycerosolvate- 32% .

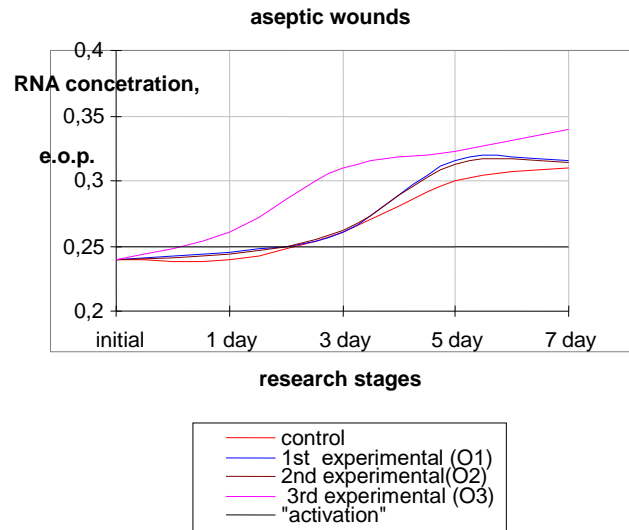


Fig 1: RNA concentration dynamics in limits of the Malpighian layer in research groups.

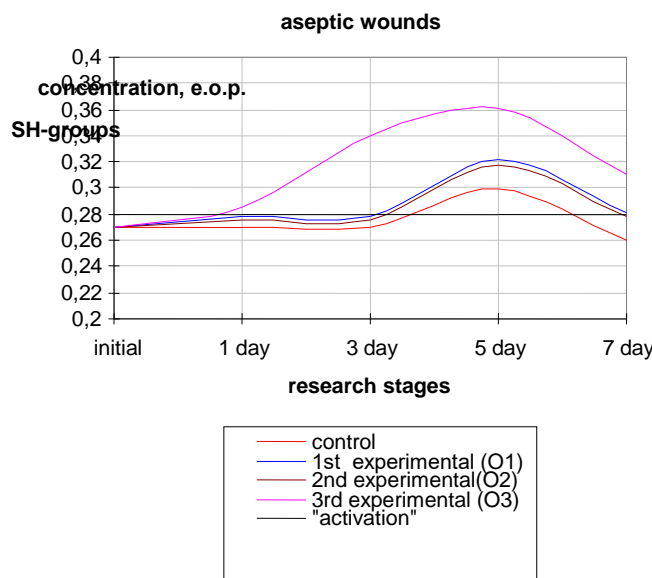


Fig 2: SH- groups concentration in limits of the Malpighian layer in research groups.

For the histochemical study, we obtained data, which corresponded to the review of the histological picture. In spontaneous wound duration of the aseptic process without medical treatment, the concentration of RNA in the growth layer (beginning, 1st, 3rd, 5th, and 7th days) amounted to 0.24 ± 0.01 , 0.26 ± 0.01 , 0.30 ± 0.01 and 0.31 ± 0.02 e.o.p. respectively (Fig. 1). On the first days, these values were not statistically different from the original (control) values. This indicates the absence of the activation of the repairing processes of regeneration. In the first experimental group, the activation of reparative processes appears at the 2.1 ± 0.3 rd day; in the 2nd experimental group - with 2.4 ± 0.13 th day; in the 3rd experimental group – 1.4 ± 0.11 th day.

The values of the concentration of SH-groups within a distinct growth layer in various stages of the study are shown in Fig. 2. A close histochemical study of the findings indicate that for the intact duration of wound during the aseptic process without treatment modalities (control group), the concentration of SH group on different stages of the study (beginning, 1st, 3rd, 5th, and 7th days.) is 0.26 ± 0.01 , 0.26 ± 0.01 , 0.28 ± 0.02 and 0.27 ± 0.01 e.o.p. respectively. On the first day, statistically the values were indistinguishable from the original (control) values. This indicates an absence of activation of epithelial differentiation structure

composed of reparative processes at this given period from the initiation of wound healing. The maturity of epithelial structures and their involvement in the process of differentiation began on the 3.2 ± 0.7 th day. In the first experimental group activation of reparative processes began on the 2.8 ± 0.3 rd day. In second experimental the activation began on the 3.0 ± 0.4 th day while in the third experimental group began on the 1.7 ± 0.3 rd day.

CONCLUSIONS

1. When analyzing the results comprehensively, we can statistically conclude that the investigated methods on aseptic wounds have proved their mechanism of action- i.e. activation of reparative processes, differentiation in the epithelial structure resulting in closing the wound defect.
2. In the case of using monotherapy techniques, injection of oxytocin has a positive impact duration of the wound. The instillation of titanium aqua-complex glycerosolvate has a medium effect on the duration of the wound. Combined use of titanium aqua-complex glycerosolvate and oxytocin has a maximum effect of early activation of reparative processes.

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