The Treatment of Wounds by Device Method in the Experiment

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Abstract: At present time wound healing is an urgent problem for the surgery. We have developed a device for the treatment of wounds. Experimentally, this device has been tested in 28 rabbits. Histological studies found that wound healing in the treatment of our device shows a good morphology.
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1. Introduction

Modern medicine and biology has a variety of ways to treat wounds, including using drugs, and different techniques and methods (Reinke and Sorg, 2012; Ali and Dahmoush, 2012; Semenov et al., 2002). But so far, there is a constant search for optimum methods to accelerate the healing of wounds, burns, trophic sores (ulcers) of the skin. Together with this a large number of pharmacological substances of natural or synthetic origin with reparative properties is known. However, properly selected surgical approach is also one of the most important factors, contributing to the favorable outcome of wound healing. Wound closure as a method of acceleration of reparative processes in the surgical wound, has been used since ancient times. Currently, a huge amount of methods for suturing wounds is available, including also device methods (Buyanov et al., 1993; Kováč et al., 2012; Sleptzov and Chernikov, 2000). It means a great dissatisfaction of surgeons with the proposed surgical techniques. Study of the problems of wound healing process is always in the center of attention (Mann and Mann, 2012., Prestes et al., 2012; Guy and Grothier, 2012).

Considering this, we have developed a device method that has the patent of the Republic of Kazakhstan № 13864 from 15.08.2007, on the basis of which several modifications were worked out.

In the course of clinical studies the ethical standards have been followed. The conclusion of bioethics commission has been received. The patients have given their written consent to the study. There have been registered several cases of patients and physicians coming at their own request due to the ineffectiveness of traditional methods of eventration treatment. (fig.1).

Histomorphological study of the wound healing process is an objective criterion for evaluating the effectiveness of treatment, which became the basis for the assessment of regenerative process dynamics in our experiment.

Objective: to examine histological picture of wound healing in the treatment by the device method designed by the author.

Fig.1 A patient with eventration wounds after bowel resection, 48 years. Recycled healing. The patient was discharged from the hospital since 9 days after the application of our method.

2. Material and Methods

The experiments were conducted on 28 rabbits of the "White Giant" breed at the age of 1,5-2 years weighing 4±0,35 kg. The wounds were applied to the skin on the back, 4-5 cm from the spine line. The incision was made to the fascia of the muscles. On one side of the wound it was stitched with traditional seams (vertical node), on the other one the hardware method was used. The main principle of the proposed method is a tight coupling of the edges of wounds to each other with the help of physico-mechanical methods (fig 2). Along the edges of the wound a long enough Nylon monofilament is applied, creating a “ligature arc”, the ends of which are fixed to the ends of the device by the author’s design.

The next day for morphogistological study the biopsies of 0,5-0,7 cm thickness were taken and fixed in 10% neutral formalin solution. Staining was carried out by conventional methods with hematoxylin and eosin, and according to van Gieson.

Ethical issues. The studies correspond the standards of international law and the legal system of the Republic of Kazakhstan and have been estimated by bioethical committees. During the experimental work none of laboratory animals will be euthanized since biopsies have been obtained only from animal skin using general anesthesia.

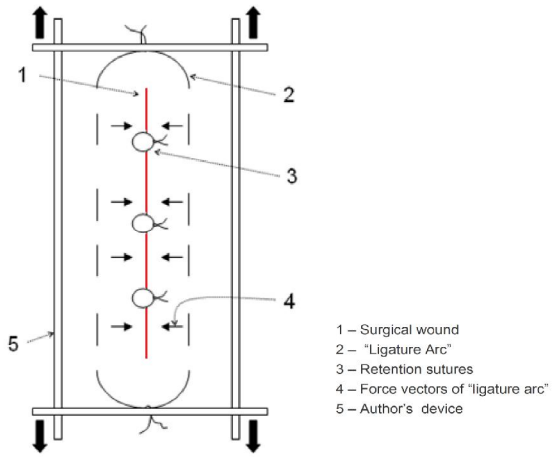

Figure 2. Diagram of the operation principle of the author's apparatus and the directions of the "ligature arc" forces action

3. Results

Conducted histological studies of the wound channel in the control series of animals have shown that in the first day the wound channel, despite the convergence of the edges of the wound suture, remains wide, made of necrotic cell masses consisting of cellular detritus, red blood cells. The edges of the wound channel are edematous, blood vessels are dilated and full-blooded. Dilation of blood vessels is connected with the violation of their permeability and the development of edema into the surrounding tissue, in addition, blood cells enter the surrounding tissue. The endothelium swells. A large number of granular white blood cells surround the suture material. By the third day the number of granular white blood cells increases, they participate in fagotcytosis of the necrotic non-viable tissues. In the edges of the wound macrophages and lymphocytes are found. Formed on the first day the powerful leukocyte shaft, which develops at the border of viable and necrotic tissues continues to persist on the 3rd day. On the fifth day on the bottom of the wound defect the young granulation tissue begins to form, which is located in separate foci. It reveals itself as a neoplasm of the capillary blood vessels type, between them fibroblasts and macrophages are visible. On the 7th day the wound healing in the control group did not take place. An abundant inflammatory infiltration of the wound edges continues to be present, particularly of the suture material (fig. 3). Swelling of the wound remains.

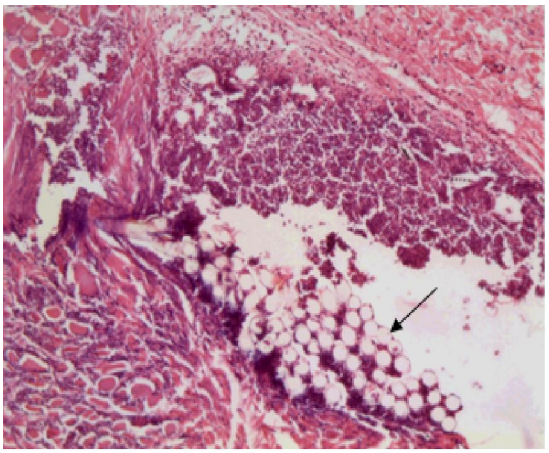

Figure 3. In the wound and around the suture material (shown by the black arrow) abundant inflammatory infiltration remains. 7th day. x200. Coloring according by Hematoxylin and Eosin

Conducted histological studies of wound channels, closed by the apparatus of own design, have shown that the convergence of the wound edges facilitates the formation of a narrow wound channel, which by the 1st day is densely filled with a mass of fine-grained cellular detritus in small amount with a mixture of granular white blood cells, the latter form a small leukocyte shaft (fig. 4).

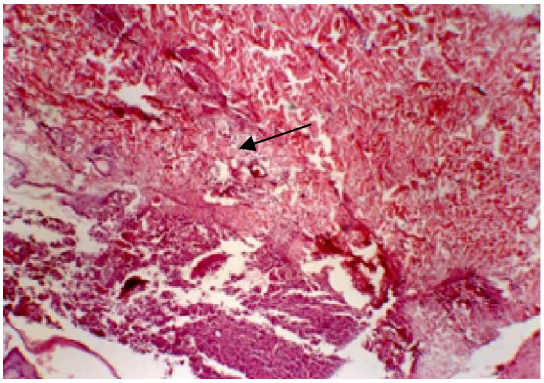

Figure 4. Small leukocyte shaft (shown by the black arrow) in 1 day after application of the author's device. ×220. Coloring according by Hematoxylin and Eosin

Even from the 5th day the bottom of the wound channel begins to be filled with granulation tissue with many blood vessels and cellular elements. Granulation is limited to the necrotic area.

The vascular lumen are rather dilated, full-blooded, their endothelium proliferates, cellular elements around the vessels are visible, mainly fibroblasts and macrophages; fibrocytes capable of intensive synthesis of collagen are found. On the 7th day a mature granulation tissue with many collagen fibers on the surface of the wound (fig. 5) is actively developing, a thin layer of necrotic tissue with leukocyte infiltration remains, the formation of lymphoid cell clusters is marked.

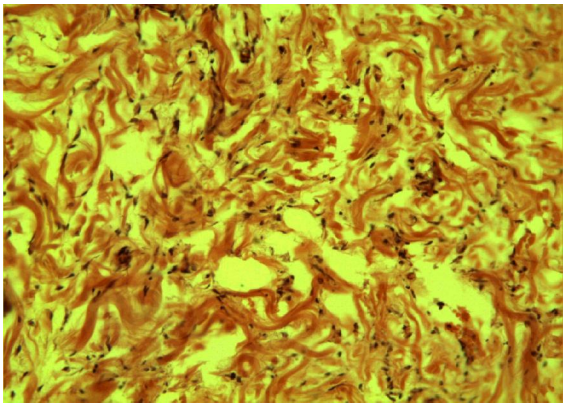

Figure 5. Growth of the collagen fibers in the bottom of the wound channel on the 7th day. ×400. Coloring according by Van Gieson

Macroscopically cured by our method wound looked more impressive than the traditional closed wound sutures (fig. 6)

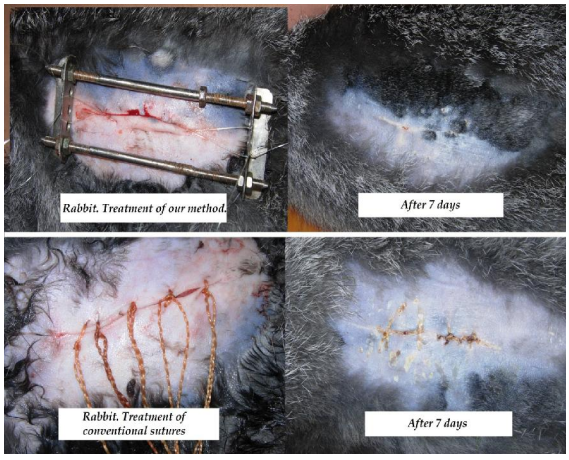

Fig.6 Comparative macroscopic rabbit skin wounds.

Conclusions:

Thus, the suture is the traditional method of suturing has a negative effect on the healing of wounds.

The main peculiarity of wound healing while using the hardware method is the acceleration of reparative processes due to reducing the number of granular leukocytes in the wound and the early appearance and more rapid maturation of granulations in the wound, and also fibrous connective tissue.

Declaration of Conflicting Interests

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References

1. Reinke JM, Sorg H. Wound repair and regeneration. Eur Surg Res. 2012; 49(1):35-43.
2. Ali. Z H. and Dahmoush H. M. Propolis versus Daktarin in mucosal wound healing. Life Science J 2012;9(2): 624-36.
3. Semenov G.M., Petrishin V.L., Kovshova M.V. The surgical suture. St. Petersburg, 2002: 3-149.
4. Buyanov V.M., Egiev V.I., Udotov O.A. The surgical suture. - Moscow: LPP "Rapid-Print", 1993. - 104 p.
5. Kováč I, Gál P, Mojžiš J. Phytotherapy of skin wounds - overview of experimental and clinical studies in the first decennium of the 21st century. Cas Lek Cesk. 2012;151(9):423-7.
6. Sleptzov I.V., Chernikov R.A. The nodes in surgery. - St. Petersburg. - 2000. - 176 p. Kostin A.E. Treatment and prevention of postoperative eventrations / / Surgery. - 1999. - № 9. – pp. 22-24.
7. Mann J, Mann DA. Epigenetic regulation of wound healing and fibrosis. Curr Opin Rheumatol. 2012.
8. Prestes M.A., Ribas C.A., Ribas Filho J.M., Modeira L.B., Boldt A.B., Brustolin E.V., Castanho L.S., Bernardi J.A., Dias F.C. Wound healing using ionic silver dressing and nonocrystalline silver dressing in rats. Acta Cir Bras. 2012 Nov;27(11):761-7.
9. Guy H, Grothier L. Using negative pressure therapy in wound healing. Nurse Times. 2012 Sep. 4-10;108(36):16, 18, 20.

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