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### Application of erythrocyte ghosts as drug carriers to treat severe soft tissue infection

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**Background:** The targeted elevation of concentration of growth factors in the wound can promote tissue repair and control of inflammation. In this context, the erythrocytes can be potentially exploited as drug carriers for effective delivery of interleukins and antibiotics to the wound site.

**Objective:** To study the feasibility of targeted delivery of interleukin and ceftriaxone by erythrocytes ('pharmacocytes') for the treatment of purulent wounds.

**Materials and Methods:** The experiments were conducted on albino rats with mass of 200.0-220.0 g (n = 28) with a model of purulent wounds. Animals in the control group were treated with the standard method, including the intra-muscular administration of the antibiotic ceftriaxone (0.01 g twice a day, during 7 days) and topical application of ointment "Levomecol" (combination of Chloramphenicol and Methyluracil). The animals from the experimental group were treated by the following technique: after standard surgical treatment of purulent wound the sterile autologous erythrocytes ('pharmacocytes') were injected to the edges and bottom of the wound. The injection contained a single dose of ceftriaxone and cytokine interleukin-1. Then the wound cavity was sutured layer by layer. After 24 and 48 hours autologous erythrocytes (pharmacocytes) loaded with ceftriaxone and cytokine interleukin-1 were reintroduced to the wound edges.

The efficacy of the treatment was evaluated by clinical signs of the progress of inflammatory processes: time of disappearance of pus and infiltration around the wound, the suppression of activity of pathogenic microorganisms, the period of normalization of the cytological picture and completing of wound healing.

**Results:** The results of treatment indicate the speeding of healing process. The disappearance of signs of the inflammation (local hyperemia, edema, pain) was observed on 2-3 days. In the control group the process of wound healing took longer time, which is common for such type of wound treatment. The application of novel system of drug delivery resulted in accelerating of regeneration processes and early formation of granulation tissue (on the fourth day). The data of microscopic investigation revealed the higher degree of fibroblasts differentiation and all signs of correct tissue remodeling.

**Conclusion:** The treatment of purulent wounds by erythrocytes (pharmacocytes) provides a high therapeutic concentration of the antibiotic and cytokines in the wound, without general toxic effects on the entire body. This leads to a more rapid arresting of the exudative phase and early start of the maturation of granulation tissue. The use of erythrocytes (pharmacocytes) provides the favorable conditions for wound healing by primary intention, which facilitates the imposition of the sutures and promotes fast recovery.

#### Biography

Kulzhan Berikkhanova has completed her MD from Semipalatinsk State Medical Institute (SSMI), Kazakhstan in 1988 and doctoral studies from University of Hiroshima, Japan in 2007. She has completed her PhD in Medical Science, Kazakhstan in 2006. Currently she is working as Scientific Secretary of the Center for Life Sciences, Nazarbayev University, Kazakhstan. She has more than 25 years' experience of surgery practice at the Semipalatinsk Emergency Hospital. She worked as Associate Professor of SSMI in 2004-2009, as Associate Professor of Astana State Medical Academy in 2009-2011. She is a PI of several research projects in the field of regenerative medicine, targeted drug delivery, wound healing, and cell technology.