Discussion. A decrease in the number of glycogen granules in the liver cells, scattered tumor cells lying outside the tumor tissue indicate the significance and intensity of the ultrasonic microflows generated by high-intensity focused ultrasound.

HIFU propagation in heterogeneous living tissues forms an acoustic field in the form of a set of spatiotemporal distributions of the characteristics of mechanical disturbances with the formation of interference maxima in local zones due to the superposition of acoustic waves from external ultrasonic and internal sources. The response of biological structures to such effects should be determined, on the one hand, by the nature of the energy distribution, the degree of manifestation of wave and nonlinear effects, and, on the other, by the characteristics of the high-frequency focused acoustic field. The combined functioning of systems, organs, tissues, cells, subcellular and molecular structures generates its own acoustic field, should be taken into account. It can be assumed that the intrinsic fluctuations of biological structures are incapable of create conditions for the interference of oscillations of biostructures and an external high-frequency acoustic field. However, molecular vibrations are capable of initiating high-frequency acoustic radiation comparable in frequency characteristics with HIFU and extend to the phenomenon of superposition of acoustic waves, witch effect poorly understood. The validity of such a theoretical calculation is still worth confirming experimentally.

Most notably, the mechanical vibrations manifest themselves in the form of a mechanical impulse, generating acoustic flows that generate microflows. Vortex microflows can cause changes in the cytolemma, cell membranes, as well as initiate transmembrane “breaks”. The inertial (unstable) ultrasonic cavitation can be source of mechanical pulses, which can occur in the form of pressure pulses and shock waves.

Thus, focused ultrasonic vibrations, which generating an architectonic complex acoustic field in biological tissues, can generate thermal and mechanical effects that affect the formation of the thermal pattern, the spatiotemporal continuum of vortex microflows in the focal zone and perifocal regions. This phenomenon is confirmed by a reducing aggregation of glycogen clumps and a separation of cells from the main tumor.

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The usage of innovative techniques for plastic closure of wound defects of the toes and wrist's fingers

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doi 10.18411/gq-31-07-2020-02
idsp sciencerussia-31-07-2020-02

Abstract

The work is devoted to assessing the effectiveness of the usage of nitrogen monoxide in the regime of NO-therapy in the treatment of patients who underwent autologous skin

plastic of wound defects of the fingers and toes. The wounds were the result of opening abscesses of the toes and wrist's fingers and were covered with a full-layer skin flap from local tissues using the moved rectangle method. The results of the study indicate that the usage of NO-therapy significantly ($p \geq 0.05$) contributed to the improvement of proximate treatment outcomes in the form of engraftment of displaced flaps (OR = 3.2, RR = 1.2). However, the revealed relationship could not be characterized as statistically significant (95% CI included 1).

Key words: foot, wrist, fingers, autologous skin grafting, local NO-therapy.

The closure of a skin defect is the most important step in the comprehensive treatment of a wound, since the restoration of the function of the affected area, and, ultimately, the quality of life and the working capacity of the individual, depends on the availability of a full cover [4]. Natural closure of the wound occurs as a secondary tension, after cleansing it of necrotic masses and filling it with granulation tissue. The granulating surface is epithelized from the edges of the wound defect [5]. In this case a rude scar that deforms the surrounding tissue can form, which violates the functions of the organ. Some wounds, due to a violation of local blood circulation against the background of concomitant diseases, cannot completely epithelize from the edges and turn, over time, into trophic ulcers. The closure of such wounds is carried out using skin grafting [1].

To close wound defects on the fingers, autologous skin grafting with a full-layer flap from local tissues is most often used using the displaced rectangle method [2]. However, post-traumatic arterioles spasm after surgery, exacerbated by compression of the capillaries with surgical sutures and tissue ischemia against a background of concomitant pathology, can lead to the formation of marginal necrosis, eruption of sutures and the displacement of a displaced skin flap. In cases of severe local ischemia, necrosis of the entire flap is possible [3]. The usage of medications to improve local hemodynamics has a delayed effect. In such situations, innovative methods of physical medicine come to the aid of doctors and patients [6].

The aim of the work was to improve the results of autologous skin plastic of wound surfaces by including in the complex of therapeutic measures local application of air-plasma flows of nitrogen monoxide (NO-therapy).

In the study, 53 patients with wound defects of the skin of the wrist's fingers and toes were divided, with their consent, into two groups - the main (25 people) and the comparison group (28 people). The groups were comparable by gender, age, concomitant pathology, localization and area of wound defects. Patients of both groups had an anamnesis of surgery for abscesses of the fingers and wounds were prepared for skin grafting. The criteria for the preparedness of the wound for autologous skin grafting were: disappearance of edema and redness of the skin around the defect; complete cleansing of the wound from fibrin and necrotic tissue with the appearance of bright granulations; bacterial contamination in the wound below 10^5 CFU. In both groups, to close skin defects, plastic was applied with a full-layer skin flap, using local tissues, according to the method of displaced rectangles (U-shaped flap). An aseptic dressing was applied from above.

Bandaging the study participants was carried out 1 time per day. In the comparison group, the dressing procedure was supplemented with local application of air-plasma flows of nitrogen monoxide in the regime of NO-therapy. For this, the Plazon air-plasma apparatus was used. The gas flow was carried out by a coagulator-stimulator at 10 cm from the outlet of the manipulator to the wound surface. The course of "NO-therapy" consisted of 5 sessions of exposure to the "recipient" site. The first session - the day after the operation and then - the next day, until the stitches are removed. The exposure time was selected considering the area of the "recipient" site and was 10 seconds per 1 cm². The patients of the main group, according to the results of informing the specialist, refused to carry out the procedure of local NO-therapy.

Sutures were removed in both groups on day 10, at the same time graft engraftment and the proximate treatment results were evaluated. Favorable treatment outcomes included episodes of complete and partial engraftment of a displaced skin flap. Adverse outcomes included non-healing, necrosis (lysis), and rejection of the displaced flap. The second stage was a comparison of the data obtained by groups. Statistical processing of the results was carried out using indicators provided by evidence-based medicine methods.

On the back of the measures taken, a favorable direct treatment outcome in the main group was obtained in 18 (72.0%) of 25 patients; in the comparison group, in 25 (89.3%) of 28 patients. Adverse treatment results were noted, respectively, in 7 patients (18.0%) of the main group and in 3 (10.7%) patients of the comparison group. The differences are statistically significant in both cases ($p \leq 0.05$). According to the calculations, an increase in the relative benefit when using local NO-therapy occurs by 19.4%, absolute - by 17.3%; decrease in relative risk - by 24.0%, absolute - by 17.3%.

The number of patients who need to be treated with the usage of NO-therapy in order to achieve a favorable outcome in one patient was 6. The odds ratio was 3.2 (> 1). Thus, the chances of developing favorable immediate treatment outcomes are greater in patients who were underwent local NO-therapy sessions. However, the observed dependence is not statistically significant ($p \geq 0.05$), since the 95% confidence interval includes 1 (the value of its lower fiducial limit is 0.74, the upper one is 14.27). The relative risk indicator was 1.2, which indicates a higher likelihood of developing favorable immediate treatment outcomes in patients who were underwent local NO-therapy. But this relationship is also not statistically significant ($p \geq 0.05$), since the 95% confidence interval includes 1 (the value of its lower fiducial limit is 0.94, the upper one is 1.63).

Thus, the use of air-plasma flows of nitrogen monoxide in the regime of NO-therapy reliably ($p \geq 0.05$) helps to improve the proximate outcome of treatment in the form of engraftment of displaced flaps (OR = 3.2, RR = 1.2). However, the identified relationship cannot be characterized as statistically significant (95% CI includes 1).

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