

ОСОБЕННОСТИ РЕАКЦИИ МАСТОЦИТОВ И ЭКСПРЕССИИ ФАКТОРА РОСТА СОСУДИСТОГО ЭНДОТЕЛИЯ В КОЖЕ В ЗАВИСИМОСТИ ОТ МОЩНОСТИ ЛАЗЕРНОГО ВОЗДЕЙСТВИЯ

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FEATURES OF MAST CELL RESPONSE AND VEGF EXPRESSION IN THE SKIN DEPENDING ON THE POWER OF LASER EXPOSURE

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The aim of the work was to study the dynamics of morphofunctional reactions of mast cells and VEGF expression in the skin of rats after infrared 970 nm laser exposure with 1.0, 3.0 and 5.0 W power. Removal of animals from the experiment was carried out 1 hour and 1 day after irradiation. The significant increase in mast cells degranulation index in the abdominal skin was noted 1 hour after irradiation with the increase in power from 1 to 5 W and as compared with the control. The study showed the VEGF expression increase in the dermis 1 hour after 1 W power irradiation and in the subepidermal, dermal and hypodermal layers 1 day after the irradiation compared with the control. When using 3 W and 5 W laser irradiation, an increase in VEGF expression was observed in all layers of the abdominal skin both for 1 hour and for 1 day in comparison with the control. Since mast cell degranulation and VEGF expression are higher after 3 and 5 W infrared laser irradiation, these parameters are preferable for stimulating microcirculation in the skin.

Keywords: mast cells; growth factor; laser; skin.

Целью работы являлось изучение динамики морфофункциональных реакций тучных клеток и экспрессии фактора роста сосудистого эндотелия в коже крыс после инфракрасного лазерного воздействия 970 нм с мощностью 1,0, 3,0 и 5,0 Вт. Выведение животных из эксперимента проводили через 1 час и 1 сутки после облучения. Отмечалось достоверное увеличение индекса дегрануляции тучных клеток в коже живота на сроке 1 час при возрастании мощности облучения от 1 до 5 Вт и по сравнению с контролем. Изучение экспрессии VEGF показало усиление по сравнению с контролем при облучении с мощностью 1 Вт на сроке 1 час в дерме и на сроке 1 сутки в субэпидермальном дермальном и гиподермальном слоях. При использовании лазерного воздействия с мощностью 3 Вт и 5 Вт усиление экспрессии VEGF по сравнению с контролем отмечалось во всех слоях кожи живота как на сроке 1 час, так и на сроке 1 сутки. Так как уровень дегрануляции мастоцитов и экспрессия VEGF выше при использовании мощностей инфракрасного лазерного воздействия 3 и 5 Вт, эти параметры предпочтительны для стимуляции микроциркуляции в коже.

Ключевые слова: тучные клетки; фактор роста; лазер; кожа.

Introduction. Mast cells are markers of laser effects on tissues, since they respond to physical effects by degranulation, regulate microcirculation, transcapillary metabolism, tissue metabolism, neoangiogenesis due to secretion of enzymes, vasoactive mediators, growth factors. The vascular endothelium growth factor (VEGF) is the main regulator of the interaction processes for enzymes and other growth factors during reparation and neoangiogenesis [1]. In the available literature there is no information on the parameters of non-damaging laser irradiation which can lead to a significant mast cell response and VEGF production in the skin. The aim of the work was to study the morphofunctional reactions of mast cells and the expression of VEGF in the skin after laser exposure to various powers.

Material and methods. The experiment was carried out on 42 rats. Laser exposure was made on the area of the anterior abdominal wall. Groups of animals: 1) intact control 2) 970 nm CW laser exposure with 1, 3 and 5 W power. The animals were euthanized after 1 hour and 1 day after irradiation. After fixation and histological sectioning, the slides were stained with toluidine blue and immunohistochemically. The statistical significance of differences in the groups was assessed using the Mann-Whitney *U*-test.

Results and discussion. The results of the study showed that laser irradiation in all cases caused a significant increase in mast cell degranulation in the abdominal skin. The significant increase in the MC degranulation index in the abdominal skin was registered 1 hour after irra-

diation with the increasing power of 1, 3, 5 W. The abdominal skin is directly accessible to laser irradiation, where the immediate effects associated with thermal processes may appear. The study of VEGF in the abdominal skin after 1 W power irradiation showed the increased VEGF expression in the dermis in 1 hour group and in all layers of the skin in 1 day group compared with the control. As for 3 and 5 W powers, an increase in VEGF expression was observed in all layers of the abdominal skin both for 1 hour and 1 day periods. For example in the dermis 1 day after 1 W power irradiation, VEGF expression was 0.22 (0.18; 0.29) r.u.;

3 W power — 0.33 (0.29; 0.38) r.u.; 5 W power — 0.38 (0.35; 0.44) r.u., i.e. the direct dose-dependent effect was observed. Considering VEGF influence on neoangiogenesis, we could suppose that enhanced expression of VEGF in the skin in response to laser irradiation formed a basis for the development of new blood vessels [1].

Conclusion. Dose-dependent increase of mast cell degranulation and VEGF expression occurred after laser irradiation of the abdominal skin of rats; 3 and 5 W power were preferred for stimulating of microcirculation and this parameters can increase the efficiency of laser therapy for vascular diseases.

References

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