Experimental Research of Biological Effects of Ozone Therapy and Radiation Therapy in Cancer Animals

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Abstract

Malignant growth is known to disbalance the correlation between free radicals and antioxidant defence system. Therefore it is necessary or to lower an oxidative level in organism (hypoxia, antioxidants therapy) or to raise concentration of radicals in a tumour (photodynamic, hyperthermia, hyperbaric oxygenation, treatment with inhalation of negative air ions, ozone therapy.

The mechanisms of intensifying of a radiation injury of a cell are connected to processes including development of free-radicals oxidation reactions in cellular membranes. In our opinion, the application of radial therapy in a complex with ozone therapy will result not only in rising selectivity of action of ionizing radiations based on oxygenous effect, but also intensifying dangerous free-radical environment of a tumor.

The aim of the present work was to research of biological effects of influence of an ionizing radiation in a combination to ozone.

The experiment was done on 500 white male rats. The neoplasia was modelled through Lymphosarcoma (LS) clone (Institute of Experimental Oncology, Moscow) inoculation. The animals were subject to following actions: mono-radial influence, intra-abdominally, intra-and para-tumourally oxygen influence and gamma-irradiation; intra-abdominally, intra-and para-tumourally ozone influence and gamma-irradiation. The radiation dose of animals has made 0.2, 1.2, 2 Gy. Ozonated saline (OS) was used at concentration of ozone in gas mixture 100, 400, 900 and 3000 μg/l. Ozone was generated from medical grade oxygen, using electrical corona arc discharge in commercial ozone generator (Russian Federal Nuclear Center –All –Russia Research Institute of Experimental Physics, Sarov, Russia).

State of free-radicals and antioxidant processes. The generation or free- radicals activity of plasma and tumor tissue was investigated by chemiluminescence methods (model of Fenton reaction). The products of lipid peroxidation: diene and trien cojugation (DC, TC), Shiff bases (SB) were measured in plasma. Superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GP) and glutathione transferase (GT) were measured in erythrocyte hemolisates and tumor tissue homogenates. Glycometabolism activity was determined of amount of glucose, lactate, pyruvat. Phagocytosis activity of polymorphonuclear leukocytes was detected by a method of luminol enhanced chemiluminescence. Chemiluminescence was measured on a BCHL-06 M biocounter luminometer (Nizhni Novgorod, Russia). The morphological and histological changes of tissues were observed. Results of all experiments were tested statistically (“Statistica- 5”).

Is shown, that the introduction OS as independent means, and in a complex with gamma-irradiation increases oxidizing reactions in tumor and suppresses it antioxidant protective properties; reduces the intensity glycometabolism in a tumor, that results in seen regressive morphological changes, namely: to increase of necrosis volume.

Conclusion

1. Intra-and para-tumourally oxygen influence of ozonated saline with ozone concentration in gas 3000 μg/l in tumor tissue results in decrease antioxidant activity, initiation of lipid peroxidation processes, decrease of glycolysis intensity, that is accompanied by regressive morphological changes Lymphosarcoma: substantial growth of necrosis volume.
2. The ozone concentration (900 μg/l) is revealed which at intra-abdominally introduction ozonated salime promotes damag primary tumor, however in 17 % of animals causes metastasis of Lymphosarcoma .
3. Combined use ozone therapy (400 μg/l) in the plan before radiation of preparation and reduced doze of ionizing radiation to a lesser degree promotes development of oxidizing stress in whole organism; and also results in normalization of a glycolysis, increase of viscosity of blood, luminol enhanced chemiluminescence of polymorphonuclear leukocytes, decrease of a internal toxicity level.

So, the results of research allow to conclude, that ozone in high concentration at local introduction has antitumor activity, and in complex use with radiation therapy raises efficiency of anticancer therapy.