

# **A PhD looks at Ultraviolet Blood Irradiation Therapy Method**

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The history of the blood irradiation therapy has been traced to the beginning of the XX century. There was an idea of applying in medicine the known bactericidal properties of UV rays by irradiating the blood of patients to destroy infectious organisms in the blood. American researchers E. Knott and V. Hancock, using E. Knott's device for extracorporeal UV blood irradiation (UBI), conducted the first successful treatment of septic infection in 1928. Later the positive influence of UBI on blood-supply, immune, respiratory, hormonal and other systems was shown, as well as improvement of microcirculation and rheological properties of the blood was demonstrated.

The equipment for extracorporeal UBI has two basic elements: a source of UV light and an irradiation chamber for irradiation of blood. The irradiation chamber is made from quartz glass, permeable for UV radiation. The treatment is carried out with different frequency - from daily up to weekly base, on a course from 3 up to 8 sessions, with irradiation of 100-250 ml of the blood during each session of UBI.

Extracorporeal UV blood irradiation launches the cascade of photochemical processes in the blood. These photochemical processes are conjugated with changes of proteins and lipids of plasma, blood cells, antioxidant and other ferment systems.

At the same time the leading role has membrane modification activity of UV radiation on erythrocytes, leukocytes and thrombocytes, which determines, on the one hand, changes in functional state and

properties of these cells, and on the other - elimination from and entering in the blood circulatory channel different biologically active substances and components of the cell surface. It was determined, that UV radiation invokes photolysis of proteins - disintegration of composite albumin molecules with formation of products both with smaller, and with greater, than initial, molecular weight. These substances play a role of antigens, launching the appropriate immune reactions in the organism of the patient. Some studies suggested that UV radiation with wavelength of 254 nm induces structural and conformational changes of thermolabile proteins of plasma, hemoglobin, ceruloplasmin, albumin, globulin etc., which cause considerable changes of functional activity of blood proteins. As a result UV radiation induced synthesis of biologically active substances - prostaglandins, hormones and so on, appearing in the blood.



One of the mechanisms of medical activity of extracorporeal UBI is the stimulation of processes of hemopoiesis. UV irradiation has positive influence on morpho-functional properties of erythrocytes. As a result of irradiation the quantity of misshapen red cells is decreasing, together with increasing their steadiness towards chemical influences. The release into the peripheral blood circulation of young cells with high metabolic and receptor activity is also recorded. The transfusion of UV irradiated blood results changing in quantitative and functional state of leukocytes. Simultaneously the changes in population of leukocytes take place - the number of immature cells is diminishes and the amount of lymphocytes, monocytes and eosinophils is enlarged. The amount of lymphocytes is enlarged in higher degree, than other leukocytes.

Extracorporeal UBI has normalizing influence on the function of hemostasis system: development of hypocoagulating effect at high hemostatic level and normalization of function of the system of hemostasis at predilection to hypocoagulation of a blood. Extracorporeal UBI affects both

parts of the hemostasis system: factors of coagulation, and factors of inhibition of coagulation of a blood, but the activation of fibrinolysis, as a rule, is more expressed. Extracorporeal UBI also reduces viscosity of the blood and improves the deformability of erythrocyte membranes, i.e. influences on hemorheology system.

It is marked that after extracorporeal UBI the oxygen transport function of blood is rising, as well as increasing artero-venous difference between oxygen and carbon dioxide level, which reflects enriching utilization of oxygen by tissues and activating the oxidize-reduction processes in them.

The bactericidal activity of extracorporeal UBI is implemented by double ways - not only and not so much due to the direct bactericidal effect of UV ray, as due to activity of the immune answer of the organism. Extracorporeal UBI results in changes of functional trends of all parts of immunodefence. UV irradiation of blood by small doses in vitro is accompanied by augmentation of phagocytic function of granulocytes, rising of an expression of receptors of lymphocytes, increasing of activity of immunoglobulins. The transfusion of UV irradiated blood in the organism causes rearrangement of the immune status, the trends and depth of which depends of its initial condition. In case of normal functioning of immune system the influence of extracorporeal UBI is not detected, in case of hyperfunction of certain elements - suppressive effect and finally normalization of the immune response of the organism is recorded. For patients with initial immunodeficiency extracorporeal UBI invokes growth of levels of T- and B- cells with simultaneous rising of function activities of these cells, increase of concentration of immunoglobulins A, M, G with parallel accumulation of antimicrobial antibodies, augmentation of phagocytic activity of granulocytes and humoral nonspecific factors.

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