

Metabolic Effects of Ozone Therapy in Restorative Treatment of Patients with 1st Degree Arterial Hypertension

Naimov Dilshod Qayim o'g'li

Bukhara State Medical Institute, Assistant of the Department of Internal Medicine,
Uzbekistan, Bukhara

Abstract: The effect of ozone therapy on the metabolic status of patients with arterial hypertension was studied. Positive changes in metabolic parameters were noted in patients with arterial hypertension after a course of treatment with medical ozone. Ozone therapy helps normalize metabolic processes in most patients, lipid and carbohydrate metabolism, and reduces the risk of atherogenic changes in the body.

Key points: arterial hypertension, ozone therapy, rehabilitation treatment, 1st.

The problem of treatment and rehabilitation of patients with arterial hypertension (AH) remains one of the pressing problems of modern cardiology and rehabilitation medicine. Despite the large number of different groups of drugs, it is not always possible to obtain the expected therapeutic effect. In the pathogenesis of hypertension, disturbances in carbohydrate and lipid metabolism and the development of insulin resistance play an important role, which must be taken into account when treating this pathology [3].

In recent decades, in Russia and other countries (Germany, Cuba, Italy, Austria, USA), ozone therapy has been used in rehabilitation treatment. Ozone (O₃) is an allotropic form of oxygen. Its most important quality as a chemical compound is its strongest oxidizing properties, surpassed in this regard only by fluorine. Medical ozone is an ozone-oxygen mixture obtained from ultra-pure oxygen under the influence of a weak electric discharge or through ultraviolet irradiation.

Intravenous infusions of ozonized saline solution have a multifaceted effect on the body. The most studied are the detoxification and antihypoxic effects. The effectiveness of the method in the treatment of patients with hypertension is associated with the effect of medical ozone on microcirculation in tissues (decreasing the tone of arterioles, increasing the pulse blood supply to organs and facilitating venous outflow), as well as the ability to have a moderate hypocoagulation effect [1, 2, 4, 6]. Parenterally administered ozone helps to increase the elasticity of red blood cells, increase the partial pressure of oxygen in arterial blood, and facilitate the release of oxygen from oxidized hemoglobin [2]. The effect of ozone therapy on lipid and carbohydrate metabolism, indicators of the hemostatic system in hypertension is an important factor in the rehabilitation treatment of such patients.

Purpose of the study: to study the effectiveness of ozone therapy in the rehabilitation treatment of patients with hypertension in terms of lipid and carbohydrate metabolism, rheological properties of blood.

There were 30 patients with arterial hypertension stages I and II under observation, of which 15 were women, 15 were men. The average age of the patients was 48.4 years (range 35 to 65 years). The diagnosis of hypertension was made on the basis of general clinical, functional and laboratory

examination methods according to the classification of MOAG and the World Health Organization. The comparison group included 20 practically healthy individuals matched by gender and age. Exclusion criteria were: grade III hypertension, secondary hypertension and complicated hypertension - a history of stroke and myocardial infarction, the presence of acute or exacerbation of chronic diseases.

Hematological parameters of peripheral blood were determined using an Abacus analyzer (Austria). The content of triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), total cholesterol (TC), and glucose in the blood serum was determined using kits from Olvex (Russia). Low-density and very low-density lipoprotein cholesterol (LDL-C and VLDL-C) and atherogenic index (IA) were calculated. The fibrinogen content was determined using a coagulometer using the Clauss chromometric method. The content of apolipoproteins A1 (apo A1) and B (apo B) was determined by kits from Dia Sys (Germany), the content of insulin was determined by the enzyme immunoassay method using kits from DRG-diagnostics (Germany).

The course of ozone therapy consisted of 6 procedures (2 times a week) of intravenous administration of 200 ml of ozonized physiological solution with an ozone concentration of 2–4 mg/l, depending on the serial number of the procedure. Blood tests were carried out before treatment and 2 weeks after treatment. All studies were performed with the informed consent of the subjects and in accordance with the ethical standards of the Declaration of Helsinki (revision 2006).

Statistical processing of the obtained data was carried out using the Statistica 6.0 program. The determination of indices of the closeness of correlations was carried out according to the method of B.I. Polyakov, the contingency coefficient - according to the method of I.N. Sezina [7]. For correct processing of statistical material, laboratory parameters were normalized relative to the parameters of the comparison group [7].

Upon admission to treatment, patients noted increased fatigue, decreased performance, headaches, and dizziness. The level of systolic (SBP) and diastolic pressure (DBP) according to repeated measurements was 130.0 ± 3.2 mm. rt. Art. and 84.1 ± 1.5 mm. rt. Art. respectively.

Metabolic parameters in patients with hypertension were characterized by increased values in comparison with the healthy group. The level of total cholesterol in 40% of patients with hypertension exceeded that in comparison with the control ($p \leq 0.01$), the TG value - in 64% ($p \leq 0.01$), there was a trend towards a decrease in HDL cholesterol (table). In the examined patients, an increase in the level of glucose and fibrinogen was revealed, respectively, by 27% and 34% relative to the parameters of healthy individuals. An increase in the level of glucose and blood viscosity observed in the subjects entails a decrease in the function of phagocytes, a decrease in the level of mature T-lymphocytes and T8-positive cells, and becomes the cause of homeostasis disorders and vascular lesions, which lead to dysfunction of the endothelium [5].

After a course of ozone therapy, patients felt improved, the intensity, duration and frequency of headaches decreased, and dizziness stopped. A tendency towards a decrease in the levels of SBP and DBP was revealed (SBP – 126.0 ± 2.1 mm Hg and DBP – 81.7 ± 0.95 mm Hg, respectively).

The leading metabolic effect of ozone therapy was the lipid-correcting effect, which manifested itself in a decrease in the levels of total cholesterol (45% of cases), LDL cholesterol (45%), LDL cholesterol (59%), AI (67%), TG (56%) and an increase in HDL cholesterol (33%). This effect is due to the fact that ozone, by oxidizing lipolic acid along its side chains, affects the production of coenzyme A and reduces the synthesis of endogenous cholesterol [2]. The change in the blood levels of apolipoproteins A1 and B was insignificant and reflected a tendency towards normalization of the initially elevated values. A decrease in fibrinogen levels was observed in 61% of patients, which is likely due to an increase in the fibrinolytic capacity of plasma under the influence of ozone [1]. The noted decrease in serum sugar and insulin levels (hypoglycemic effect in Special issue 30% of patients) is apparently associated with ozone stimulation of the pentose-phosphate shunt and aerobic glycolysis, causing a decrease in blood glucose levels due to its more active entry into the tissues [2].

The use of correlation analysis to assess the effectiveness of ozone therapy made it possible to identify a tendency towards a decrease in the strength of conjugation of system elements after treatment in comparison with the results before treatment. The coefficient indexing the level of intensity of metabolic parameters before treatment was 0.33. After the course of treatment, the indicators of conjugacy of connections between metabolic parameters decreased by 10%, which indicates a positive dynamics of changes.

Ozone therapy helps normalize metabolic processes in most patients, both lipid and carbohydrate metabolism, reducing the risk of developing atherogenic changes in the body. Medical ozone is an effective therapeutic agent that mediates its effective effect on the etiopathogenetic mechanisms of hypertension, has a beneficial effect on the rheological properties of blood, has a sanogenic effect in vascular reactions that underlie the formation of hypertension, corrects disturbances in oxygen delivery and consumption by tissues, reducing the severity of asthenovegetative syndrome, improving the quality of life of patients.

The effect of resistance to this treatment method identified in some patients requires further study for a differentiated approach to the prescription of ozone therapy.

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