Ozone Therapy in the Internal Medicine

Hepatitis

The treatment of hepatitis is one of the most important aspects of using ozone therapy. In this case a therapeutic effect of ozone develops both through its direct action on the virus and indirectly through its immunomodulating action. Ozone therapy is effective in treating all types of viral hepatitis - A, B, C, particularly its chronic forms.

Ozone affects the polypeptide chains of virus membrane therefore making it unable to adhere to target cells (hepatocytes) as well as changes the activity of reverse transcriptase enzyme involved in the synthesis of virus proteins and thereby blockades a reproductive cycle of virus (Freberg, Carpendale, 1988). The capsulated viruses are more sensitive to ozone as the capsule contains more lipids, which easily react with ozone. Additional supply of peroxides induced by ozone considerably intensifies the cell phagocytic activity always decreased in hepatitis.

Ozone therapy activates both the cellular and humoral immunity. Ozone therapy induces an increase in the formation of cytokines, in particular interferon, one of the most important factors of the endogenous organism's defense against viral infection that results in an increase in the synthesis of T-killers, which are responsible for the humoral immunity, normalization in the formation of T-helpers regulating the function of B-lymphocytes, which in turn produce immunoglobulins. The above-mentioned leads to suppression and elimination of the inflammatory process.

Ozone exerts a positive influence on the haemostasis by inducing a decrease in the thrombocyte aggregability, an increase in the fibrinolytic activity and hypocoagulation of blood that prevents the development of secondary reactive inflammation: micronecrosis and microthrombosis.

Active oxygen increases the elasticity and deformability of the erythrocytes thus improving their oxygen-transport function and accordingly microcirculation and oxygenation of the tissues. It comes to elimination of misbalance between the oxidative free-radical processes and synthesis of endogenous antioxidants.
In alcohol-induced hepatitis the formation of peroxides induced by ozone initiates the antioxidant detoxication mechanism of the glutathione system, which plays a defending role in the hepatocyte when the lipid peroxidation processes are activated.

The recommended methods of ozone therapy:

Major autohaemotherapy with ozone;
Intravenous drop-by-drop infusions of ozonated saline solution;
Rectal ozone insufflations;
Minor autohaemotherapy with ozone
After the treatment course it comes to positive dynamics of biochemical and immunological indices of blood (increase in the hyperbilirubinemia, indices of AcAT, ALAT, alkaline phosphotase, normalization of albumin-stimulating function), disappearance of viremia in 60% of cases (A.V. Zmyzglova, N.P. Isaeva, 1998). It comes to inhibition of lipid peroxidation processes and at the same time activation of the antioxidant defense system.

It comes to a considerable improvement in the indices of systemic and intrahepatic microcirculation according to the data of rheohepatography and biomicroscopy (V.V. Nedogoda, O.Yu. Sviridenko, 2000). It is important to note that the treatment is well tolerated by patients; any aggravations or complications have been not established. Ozone therapy in the treatment of hepatitis can be used as a complementary method or monotherapy. It is necessary parallel to use antioxidants.

Chronic Colitis

Non-specific colitis is a polyetiological disease.
Sometimes the etiology of colitis is not clear to both the patient and attending doctor, and the today therapy represents symptomatic attempts of antiphlogistic approach.

Thanks to the well-known bactericidal, viricidal and fungicidal properties of ozone as well as through its anti-inflammatory effect, the effect stimulating the circulation and immunity rectal ozone insufflations offer a complementary possibility of colitis treatment. In the process of resorption of active oxygen through the intestinal wall it comes to its reaction with the inflammatory products of metabolism, elimination of acidic, hypoxytic medium, regeneration of intestinal epithelium. Ozone activates the phagocytosis, pulls the levers of humoral immunity that results in the restoration of homeostasis, normalization of microbial balance, remission of inflammation symptoms. An increase in the pO2 in the blood leads to normalization of intestinal motility. Finally, rectal ozone insufflations have a generally stimulating effect. This positive influence of ozone is particularly important for the psychic state of colitis patient.

For treatment of colitis please remember that high ozone concentrations have a blood-stopping effect, and low ozone concentrations intensify blood circulation (H.H.Wolff, 1998). In patients with chronic colitis ozone therapy does not cause any body resistance to this kind of therapy, prolongs the period of remission (H.Knoch, W.Klug, 1990). To support the achieved therapeutic effect in this pathology it is necessary to perform a course of ozone therapy 2-3 times a year. In contrast to many antiseptics, ozone does not produce a destroying or corrosive effect.

The recommended methods of ozone therapy:

Rectal ozone insufflations;
Minor autohaemotherapy with ozone;
Acupuncture therapy with ozone.
Chronic Gastritis & Gastroduodenitis

Ozone has proved to be effective in treating chronic gastritis and gastroduodenitis associated with Helicobacter pylori through its influence on the main pathogenetic mechanisms of these diseases: the bactericidal action against numerous bacteria and helicobacter; the anti-inflammatory effect through the oxidation of arachidonic acid that is a predecessor of prostaglandin E initiating the inflammatory process; the immunomodulating and anti-aggregating effects as well as the analgesic effect.

Recently, several variants have been developed and clinically tested for treatment of this pathology with ozone/oxygen gas mixtures including different combinations of available methods of ozone therapy. For example, combination of rectal ozone insufflations, minor ozonated autohaemotherapy, ozonated oil and water per os (S.V.Andosov, V.I.Almazov, 2000); combination of intravenous infusions of ozonated saline and ozone gas injections into the biologically active points.

The received clinical results have been verified through the endoscopic, histological, biochemical, immunological investigations. On the 2nd or 3rd day of treatment it comes to elimination of endotoxic symptoms, pain and dyspeptic syndrome; improvement of defense properties of mucoepithelial barrier that results in an increase in the height of surface epithelium and stimulation of the main function of mucocytes (S.D.Karataev, V.A.Maximov, 2000). It comes to a decrease in the deficit of secretory IgA produced by the lymphocytes and plasmatic cells of lymphoid tissue of gastric mucous membrane. One of the most important indicators for successful therapy is a long-term relapse-free period. In this pathology ozone therapy has proved to be an ideal monotherapy, but when used in combination with physical therapy it is possible to increase the efficiency of treatment (I.P.Shmakov, 2001).

Ulcerous Disease

The many-sided action of ozone therapy in the treatment of ulcerous disease mostly develops through its anti-inflammatory, anti-helicobacter, regenerating and stimulating effects. Owing to its interaction with the microflora, ozone produces a powerful bactericidal effect and decreases resistance of the remaining microorganisms to antibiotics. Active oxygen ensures elimination of tissue hypoxia and creates favorable conditions for regenerative processes improving the disturbed microcirculation at the pathological area through the spasmolytic action and normalization of the rheology of blood. This results in acceleration of ulcer epithelization, disappearance of mucosal infiltrate much faster than after the traditional therapy.

A decrease in the inflammation of gastric or duodenal mucous membrane is achieved both through the systemic action via the parenteral route of administration of ozone/oxygen gas mixture and local action of ozonated products. An increase in the immunity through ozone therapy considerably improves remote results of treatment and reduces a risk of disease recidivation. Ozone therapy can be used as a monotherapy or in combination with other therapeutic methods.

Recommended methods of ozone therapy:

Ozonated water;
Ozonized oil;
Rectal ozone insufflations;
Minor autohaemotherapy with ozone;
Intravenous drop-by-drop infusions of ozonated saline solution;
Acupuncture therapy with ozone.

One of the clinical investigations included 69 patients (10 with gastric ulcer and 59 with duodenal ulcer) in the period of aggravation, who received ozone therapy as a monotherapy. The results received in the treatment of 8 patients with gastric ulcerous disease were interpreted as a significant improvement: complete ulcer scarring and disappearance of all disease symptoms. In 2 cases clinical symptoms of disease were completely removed, but ulcer healing was not complete, and the result of treatment was evaluated as an improvement in the patient's condition.

The patients with duodenal ulcerous disease after the course of ozone therapy showed a significant improvement in 56% of cases, an improvement - in 39% of cases, a partial improvement with some symptoms remained and incomplete ulcer healing - in 5% of cases. Ozone therapy can be used both as a monotherapy and in addition to drug therapies. Its anti-bacterial effect is particularly important. It can substitute the use of antibiotics and metronidazol. Moreover, ulcer healing, elimination of mucosal infiltrate, eradication of Helicobacter Pylori are achieved through ozone therapy in considerably more cases than with traditional treatment (V.A. Maximov et al).

Chronic Bronchitis

The immunomodulating properties of ozone can be useful in the treatment of chronic bronchitis. Ozone therapy facilitates the normalization of anti-infective immune response of the organism to viral-bacterial infection. That results in the tension of the local and general immunity, which is decreased in chronic bronchitis. As a result of treatment, in bronchial contents and mucosal cells as well as in peripheral blood it comes to an increase in the total number of T-lymphocytes and T-helpers stimulating the proliferation of B-cells and the formation of antibodies. There is an increase in IgA and IgM in blood serum, an increase in the circulating immunocomplexes and an activation of phagocyte neutrophiles. The indices of secretory IgA in bronchial contents return to normal.

With remission of bronchial inflammation it comes to an increase in the suppressive activity indicating the adequacy of immune response. The absorbability of monocytes and neutrophiles of peripheral blood is activated providing the elimination of causative agents.

Ozone therapy can be successfully used in the treatment of obstructive bronchitis, which is characterized by respiratory insufficiency of different manifestation. Persistent bronchial obstruction does not only result in the progressive respiratory insufficiency, but also facilitates pulmonary hypertension. The vasodilating properties of ozone can be particularly useful in this case. The improvement in the oxygen-transport function of blood through the parenteral introduction of ozone/oxygen gas mixture i.e. by moving aside the lungs, the increase in the release of oxygen to the tissues result in the removal of hypoxemia and tissue hypoxia.

Recommended methods of ozone therapy:

Intravenous drop-by-drop infusions of ozonated saline solution;
Rectal ozone insufflations;
Minor autohaemotherapy with ozone;
Acupuncture therapy with ozone;
Inhalations with ozonated water.

The results of ozone therapy used in patients with chronic bronchitis were the following: in 79% of patients - an improvement in the condition, in 29% of cases - a significant improvement i.e. the complete disappearance of cough, dyspnea, weakness, lung wheezing; in 21% of cases - satisfactory results of treatment.

Bronchial Asthma

The effect of ozone therapy develops through its many-sided action on the pathological process. First of all, this is the ability of ozone to remove bronchospasm that occurs due to the dilatating effect on smooth musculature through NO-radical produced in the endotheliocytes under the action of ozone.

Of great importance is the ability of ozone to remove tissue hypoxia, which always develops in patients with bronchial asthma due to pulmonary insufficiency, resulted from bronchospasm. The transport of oxygen to blood past the lungs, the increased release of oxygen to the tissues, the improvement in the flow properties of blood are the basis for removal of hypoxia.

An increase in oxygen supply leads to the normalization of organs and systems, in particular the immune system. The organism's immunological mechanisms are oxygen-dependent as the adequate chemotaxis and phagocytosis with generation of oxygen free radicals by the macrophages and granulocytes in response to infection require appropriate oxygen supply.

The immunological effect of ozone develops through the activation of the production of cytokines - interferons, tumor necrosis factor, interleukins. The latter ones activate the cell-bound and humoral immunity. It comes to the intensification of the synthesis of T-killers, which are responsible for the cell-bound immunity, normalization in the production of T-helpers regulating the activity of B-lymphocytes regarding the synthesis of immunoglobulins.

The stimulation of the immune system facilitates the suppression of the inflammatory process owing to the decreased activity of effector cells and their decreased production of biologically active substances providing bronchospastic reactions.

The anti-viral and anti-bacterial effects of ozone are also of great importance. The bactericidal action of ozone is similar to the organism's own processes focused on the destruction of foreign antigens. Ozone intensifies the action of free radicals owing to the increased phagocytic ability of leukocytes. Besides, ozone penetrates into the microbial cell and directly reacts with cytoplasma proteins thus disturbing bacterial proliferation.

The anti-viral mechanism of ozone develops by damaging the polypeptide chains of viral membrane that disturbs the ability of virus to hold on the cells. It also comes to the breakdown of one RNA chain into two parts that stops the reproductive process of viruses. The protective action of ozone towards the intact cells is important. The defense against viruses is provided through the activated synthesis of interferon and the intensified elimination of virus-infected cells.

Recommended methods of ozone therapy:

Intravenous drop-by-drop infusions of ozonated saline solution;
Rectal ozone insufflations;
Major autohaemotherapy with ozone;
Acupuncture therapy with ozone;
Inhalations with ozonized distilled water.
One of the investigations included 42 patients with bronchial asthma who received one course of ozone therapy. Most of the patients (83%) had moderate severity of disease. After the course of ozone therapy a significant improvement in the patient's condition (a decrease in dyspnea attacks more than twice and in the dosage of drug therapy) was observed in 86% of patients. In 7% of patients asthmatic attacks were completely stopped by gradually rejecting the use of medicines. In 7% of cases there was no improvement.

Diseases Associated with Atherosclerotic Arterial Disturbances

(ischemic heart disease, discirculatory encephalopathy and atherosclerotic arterial disturbances of the lower limbs)

The efficiency of ozone therapy in the treatment of the above diseases is associated with 4 mechanisms of action of ozone therapy providing a therapeutic effect:

Influence on the lipid peroxidation processes and the antioxidant defense system;
Anti-inflammatory action;
Hypocoagulation action;
Influence on the oxygen-transport function of blood.
Lowly concentrated medical ozone used in cases of atherosclerotic disturbances increases not so much lipid peroxidation as activates the antioxidant defense system, normalizes a correlation between them and thus eliminates the toxity of lipoproteins and consequently decreases the disturbing factor for arterial wall.

That was verified in the course of investigations into the influence of ozone therapy on the lipid peroxidation processes and the antioxidant defense system in blood serum by biochemiluminescence method.

Ozone used at appropriate concentrations activates the antioxidant defense system, in particular the enzymatic one, by inducing an increase in the activity of superoxidedismutase and catalase as well as glutathione that inhibits the reaction of free-radical lipid peroxidation and prevents ischemic tissue lesions.

The anti-inflammatory effect of ozone is well-known. In this field it can be confirmed by high clinical efficiency achieved in acute vascular catastrophes (acute myocardial infarction, apoplectic attack, unstable stenocardia) as well as by laboratory indices indicating a decrease in the inflammation. The suppression of the inflammatory processes results in the stabilization of atheromatous plaque.

From this point of view ozone therapy can be considered a preventive method as regards the progression of atherosclerotic arterial disturbances.

The investigation into the influence of ozone therapy on the indices of hemostasis and fibrinolysis in patients with atherosclerotic arterial disturbances of different localization showed positive results including a decrease in thrombocyte aggregability, an increase in fibrinolytic activity and hypocoagulation of blood, a decrease in fibrinogen. It is important to point out that this dynamics took place only in cases of changed indices and manifested in shifting average values to the lower limits of standard. Thus, ozone therapy facilitates the normalization of the hemostasis.

The erythrocytes are the main objects of the interaction between ozone and blood. This is because the erythrocyte membrane contains a great amount of phospholipids with the chains of unsaturated fatty acids. Ozone (oxygen atoms) directly reacts with the double bonds of fatty acids by converting them into the short-chained compounds. As a result, the erythrocyte membrane becomes more elastic that increases the deformability and the flexibility of the erythrocytes and improves the flow properties of blood. An activation of the erythrocyte metabolism occurs. With the assistance of the glutathione system an activation of glycolysis takes place, which results in an increase in 2,3-diphosphoglycerate (2,3-DPG) that is the essential mechanism of the therapeutic action of ozone as it loosens the hemoglobin-oxygen bond and facilitates the release of oxygen to the surrounding tissues:

$HbO_2 + 2,3\ DPG\ Hb * 2,3\ DPG + O_2$

Moreover, an increase in the release of oxygen takes place in the parts of tissues with the disturbed circulation.

Ozone does not only improve the transport of oxygen in atherosclerotic ischemic conditions, but also participates in the more deep metabolic processes, in particular, it exerts influence on the oxidoreduction processes, which take place in the metachondrial respiratory chain. This improves the use of arterial oxygen towards the removal of hypoxia conditions and the restoration of cell functions.

In cases when ozone therapy was performed in a treatment cycle as regards discirculatory encephalopathy and atherosclerotic arterial disturbances of the lower extremities, it was used as a monotherapy with ozone-oxygen gas mixtures. However, the patients with ischemic heart disease received ozone therapy within the use of previously prescribed coronary-active medicines, which were continually administered. In these cases with an improvement in the patient's condition the dose of medicines was gradually reduced and if possible they were completely rejected.

<u>Recommended methods of ozone therapy:</u>

Intravenous drop-by-drop infusions of ozonated saline solution;
Rectal ozone insufflations;
Major autohaemotherapy with ozone;
Minor autohaemotherapy with ozone;
Acupuncture therapy with ozone;
Ozone/oxygen gas irrigation by means of plastic bags in high-pressure conditions.
Results of ozone therapy used in patients with atherosclerosis

Disease Number of patients Results of treatment, %
Significant improvement Improvement Satisfactory Unsatisfactory
Ischemic heart disease 180 41 50 7 2
Discirculatory encephalopathy 78 37 41 11 11
Occlusive arterial athero-sclerosis of the lower limbs 129 65 31 2 2

Cardiac Rhythm Disturbances (Arrhythmia)

The mechanisms of development of cardiac rhythm disturbances are not absolutely clear, in particular, an increase in the lipid peroxidation products in the myocardium is one of the reasons for arrhythmia. The conductive system of heart is less resistant to the disturbing effects of free-radical reactions than the working myocardium (F.Z.Meerzon etc, 1984). The therapeutic doses of ozone increase the antioxidant activity and decrease the lipid peroxidation processes that results in the restoration of membrane structure and electrolyte balance of cardiocytes, elimination of local conduction disturbances. Ozone therapy develops a hypolipidemic effect that in turn decreases a risk of arrhythmic syndrome (A.V.Nedostup, 1996). Along with an increase in gas exchange in the tissues owing to the oxidative properties of ozone, it prevents intracellular accumulation of not-esterified fatty acids and some products with distinct arrhthmogenic activity (Opie, 1984; Rizzon, 1989).

Recommended methods of ozone therapy:

Intravenous drop-by-drop infusions of ozonated saline solution
The oxidative therapy leads to shortening of paroxysms, an increase in remission time of sinus rhythm. The echoscopy investigation has shown an improvement in cardiac contractility, an increase in stroke volume and cardiac output per min. It comes to normalization of lipid spectrum, a decrease in fibrinogen, prothrombin index, an improvement in the patient's general condition, an increase in workability.

Hypertensive Disease

In hypertensia ozone therapy is used in a complex with hypertensive medicaments that improves a therapeutic effect. Medical ozone facilitates normalization of vascular-thrombocytic hemostasis that results in the regulation of membrane disturbances in hypertensia, optimization of haemodynamics and cardiac contractility, decrease in general peripheral vascular resistance and lipid peroxidation activity.

Recommended methods of ozone therapy:

Intravenous drop-by-drop infusions of ozonated saline solution;
Rectal ozone insufflations
Owing to the complementary use of ozone therapy, the patients showed disappearance of headache, giddiness, pain in the field of heart, stabilization of arterial pressure, removal of resistance to medicaments earlier than after standard treatment. The received results were achieved through improvement in the oxygen supply to kidneys, brain. The dynamics in the indices of hemostasis and fibrinolysis in patients with this pathology of blood was observed as follows: a decrease in the aggregability of thrombocytes, fibrinogen level, an increase in the fibrinolytic activity.

Diabetes mellitus

(diabetic complications kindly see in the section "Surgery")

Ozone therapy in the complex treatment of diabetes mellitus has proved to be particularly effective as ozone is able to affect the most important pathogenetic mechanisms of this disease.

Ozone increases penetrance of cell membranes for glucose by stimulating pentose phosphate cycle and aerobic glycolysis, which are suppressed in diabetes, and this induces a decrease in the hyperglycemia due to improvement in the release of glucose to the tissues.

The both processes in turn intensify the production of glutathione, which participates in the synthesis of glycogen and fat from glucose as well as in the synthesis of proteins. Glucose oxidation occurs including the end products. As a result, the main function of carbohydrates - energy supply - is restored. The energy deficiency of the tissues is eliminated. The way of endogenic production of glucose from glycogen and protein is inhibited i.e. the gluconeogenesis is suppressed. The breakdown of protein is decreased, and the catabolic processes are suppressed. Lipid peroxidation returns to normal. Thus, ozone performs a number of functions characteristic of insulin.

The next important point is that the activation of glucose metabolism in the erythrocytes through ozone results in the increased production of 2,3-diphosphoglycerate that loosens the hemoglobin-oxygen bond and facilitates the release of oxygen to the tissues. Since the patients with diabetes mellitus show dominance of the so-called glycolized hemoglobin with stable affinity to oxygen and the resulted tissue hypoxia defines the severity of disease, the removal of hypoxia conditions through ozone therapy plays a key role in the course of treatment.

By inducing a decrease in the hyperglycemia, an increase in the release of glucose to the tissues, by improving oxygen supply and by removing hypoxia conditions, ozone therapy prevents the development and progress of processes associated with insufficient supply of glucose to the cell: sorbitol accumulation in the tissues that leads to cataract, neuropathies, microangiopathies; formation of glucoseaminoglycanes which are responsible for arthropathies; synthesis of glycoproteins that results in the progression of angiopathies.

As a preventive and therapeutic method ozone therapy is used in elderly diabetes patients suffering from atherosclerotic disturbances of the cardiovascular system such as ischemic heart disease, discirculatory encephalopathy, occlusive arterial atherosclerosis of the lower extremities.

Ozone therapy of diabetes mellitus is primarily characterized by its immunomodulating effect. It is particularly important for insulin-dependent form of disease when owing to antigens and antibodies in autoimmune and virus-induced forms of disease the cytotoxic reaction results in the destruction of B-cells. These forms are characterized by the production of insulin-inactivating antibodies.

Insulin-independent diabetes is characterized by the suppression of immunity that increases a tendency to chronic infections (pyelonephritis), pustular lesions (furunculosis).

Recommended methods of ozone therapy:

Intravenous drop-by-drop infusions of ozonated saline solution;
Rectal ozone insufflations;
Minor autohaemotherapy with ozone;
Subcutaneous injections of ozone/oxygen gas mixtures;
Acupuncture therapy with ozone.
NB: Owing to the hypoglycemic effect of ozone, during the treatment it is necessary to carry out a continual control over the blood level of glucose as well as to correct the dosage of sugar-reducing preparations used.

Results of ozone therapy used in patients with diabetes mellitus

Diabetes type Number of patients Results of treatment, %
Significant improvement Improvement Satisfactory Unsatisfactory
Insulin-dependent 26 - 87 13 -
Insulin-independent 64 17 74 3 6

The data given in the table show that a positive effect was achieved in the treatment of both insulin-dependent and insulin-independent types of disease. It was manifested as a decrease in the hyperglycemia, a decrease in thirst, removal of polyuria, skin itch, weakness (E.E. Pavlovskaya). Most of the patients treated with ozone therapy showed a compensation of the condition that is considered the main criterion of successful treatment.

It is recommended to perform repeated courses of ozone therapy every 3-6 months, any side effects have been not observed.

Rheumatic Diseases

The therapeutic effect of ozone therapy is related to its ability to influence many sides of the pathological process. An increase in oxygen supply leads to normalization in the function of the body's organs and systems, in particular the immune system. The immunomodulating effect of ozone is manifested as activation of the production of cytokines by lymphocytes and monocytes. After coming into blood the cytokines activate both the cellular and humoral immunity. It comes to intensification of the synthesis of T-killers responsible for the cellular immunity. It comes to normalization in the production of T-helpers regulating the work of B-lymphocytes directed to the synthesis of immunoglobulins. Stimulation of the immune system facilitates inhibition of the inflammatory process that results in a decrease in the activity of effector cells and a decrease in the production of biologically active substances by them.

Ozone used in adequate doses leads to activation of the antioxidant defense systems, in particular the enzymatic one, which inhibits free-radical reactions and prevents tissue damage. Being involved into deep metabolic processes ozone facilitates better utilization of oxygen for hypoxia elimination and restoration of cell functions.

Recommended methods of ozone therapy:

Major autohaemotherapy with ozone;
Intra- and peri-articular ozone injections.
After 2-3 sessions of major AHT it comes to a shift in the clinical picture of disease. It comes to an improvement in the general feeling, elimination of pain syndrome, an increase in the volume of active and passive movements in the affected joints, normalization of the blood picture, stabilization of the antioxidant activity indices. After the main course of ozone therapy it is possible to use supporting doses of ozone. Ozone therapy as a component of complex treatment for rheumatic pathology increases a period of remission and makes less severe the course of disease.