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Ozone: active forms of oxygen, nitrogen oxides and high-intensity. Its physical factors in biology and medicine.

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Abstract Book

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OZONE, EHF-THERAPY IN COMPLEX TREATMENT OF CHILDREN

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The **aim of the study** was to examine the effect of integrated use of ozone, EHF-therapy in children with abdominal pathology.

Material and methods

Under our supervision there were 100 sick children with complicated forms of acute destructive appendicitis. 70 patients study group and 30 - control. The patients' age from 1 year to 14 years.

The results and discussion

All children were operated on for destructive forms of appendicitis, complicated by distributed peritonitis. Patients of the studied groups since the income received comprehensive treatment with medical ozone, EHF-therapy apparatus "Amfita". Transfusion etnonacional 0.9% NaCl solution with ozone concentration of 1.0 mg/l at a dose of 5-8 ml/kg of body weight in children under 5 years and at a dose of 8-10 ml/kg in children older than 5 years was carried out intravenously. In the course of surgery etnonacional solution of sodium chloride and sonenshine the antiseptic solutions used for intra-operative lavage of the abdominal cavity.

The daily dose of ozone in children in the acute period of intensive care amounted to $148,2 \pm 2,1$ mg/kg in the youngest age group and $131,6 \pm 1,4$ mg/kg in older children. Evaluation of the analgesic effect of complex treatment was performed according to the method Boyarinov G. A. et al. (2002).

Conclusion

In the complex treatment with ozone (intravenous and rectosigmoidal informatsii) in combination with EHF – therapy resulted in a reduction in the duration of application of AB to 10-11 days instead of the 18-19 days in control. In the early postoperative period and subsequent days in 82.3% of patients of study group had not used narcotic analgesics, which is especially important in children. In the main group in the postoperative period earlier than in the control group, normalized sleep, restored appetite, decreased body temperature.

Keywords: ozone, EHF-therapy, abdominal pathology, children

EVALUATING THE EFFECTIVENESS OF THE USE OF OZONE THERAPY IN THE TREATMENT OF COMBAT TRAUMA WITH BRAIN DAMAGE

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The paper studied the efficiency of the use of ozone therapy in the complex treatment of servicemen Donetsk People's Republic, who received the first combat injury with brain damage in the period from October 2014 to April 2015. For the study, patients were selected for the First Military Hospital DNR aged 18 to 44 years (mean age 32 years) with a diagnosis of concussion (62 people) and contusion of the brain mild (35). Basic therapy in the control group (46 people) included the use of L-lysine aescinat, magnesium sulfate, cerebrolysin aktovegina, B vitamins asparkama, diuretics, nimodipine, antihypertensive treatment (if necessary). In the experimental group (51 people) were used, in addition to the above-mentioned drugs, infusions of ozonated saline solution. 200 ml. 0,9% NaCL 15 minutes ozonated solution concentration of 3.5 mg / liter at a rate of 0.5 liters per minute using the apparatus "Medozons BM". Infusions were carried out once daily for 25 - 30 minutes. The course consisted of 10 injections. the severity and duration of clinical signs of the existence, terms of recourse morbicheskoy simtomatiki were analyzed. When using ozone therapy complaints and symptoms of injuries regressed considerably earlier. Headaches, stupor, irritability disappeared on day 2, background mood increased after 1 session of ozone therapy. After 1-2 days noted persistent blood pressure normalization. Total persistent restoration of disturbed functions mentioned through 5-7-10 days, while in the control group recovery was noted at 10 -14 days.

Key words: military closed brain injury, ozone therapy

APPLICATION OF LOCAL OZONE THERAPY IN THE TREATMENT OF EXTERNAL FISTULAS

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This article contains two cases of incomplete external fistula treatment by local application of ozonized 0,9% NaCl solution. Clinically assessed the efficacy of the topical treatment compared with conventional therapy. It is shown that washing fistulous ozonated 0.9% NaCl solution can achieve in the observed cases, an early relief of the pathological process. In the presence of purulent apportion fistulous efficient application of the solution, the ozonized directly during readjustment of a fistula with a concentration of 10 mg ozone / liter lavage at a rate of 0.5 liters per minute. Volume - depending on the magnitude of purulent cavity. If discharge serous nature is effectively use ozone solution having a concentration of 7 mg / l at the same rate.

Key words: ozone therapy, sanitation of fistulous

The nitric oxide and ozone in complex treatment of widespread peritonitis

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The data of ORPP treatment has been analyzed by surgical department of Smolensk Emergency Hospital and Smolensk Regional Hospital. A surgery included peritonitis source elimination, bacteriological analysis of an exudate, abdominal drainage, and sanitation of the abdominal cavity, which was conducted by original technique of joint use of OFR, and NO-comprising air-plasma flow generated by air-plasma machine «Plazon». The final stage of surgery included a probe intestinal decompression, and followsozonated saline lavage. The ozonated saline was received from ozone therapeutic machine UOTA-60-01 «Medozon» and consisted of 4-6 mg/l ozone concentration. Medical support included the following: intensive care with hemodynamic, pulmonary, and renal support, inflammatory response modulation therapy, parenteral and enteral support, NO-therapy. Stabilization of indicators of systemic hemodynamics and elimination of symptoms of pulmonary dysfunction in the core group was happened in 2-3 days earlier than in control group. Significant decrease of endotoxemia indicators was observed in 3-4 days, whereas in control group in 5-6 days. Cupping of intoxication symptoms was accompanied by recovery of intestinal motor function. Using ozone and NO-comprising air plasma flows reduced the frequency of postoperative complications among the patients of core group. So, adequate interoperability tool, intraperitoneal sanitation using ozone and NO, intracorporeal detoxication methods (nasointestinal intubation and intestinal lavage dissolved with ozone) should be conducted. The results of our research allow to recommend the developed technology using ozone and NO in purulent peritonitis treatment.

Key words: nitric oxide, ozone, generalized peritonitis, endotoxemia

THE USE OF TAURINE FOR THE CORRECTION OF OXIDATIVE STRESS IN ADOLESCENTS WITH FATTY HEPATOSIS ACCORDING TO ELASTOGRAPHY

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Introduction

The prevalence of nonalcoholic fatty liver disease (NAFLD) over the past 20 years has doubled. It is generally accepted the view that NAFLD is the hepatic manifestation of metabolic syndrome, which is manifested by the world epidemic of diabetes and obesity. Objective: to evaluate the effectiveness of metabolic correction (taurine) disorders of oxidative status in adolescent children with fatty liver.

Material and research methods

The study included 40 adolescents with primary obesity and fatty liver. The 1st group consisted of 17 children with fatty liver who did not receive drug therapy. The 2nd group consisted of 23 children with fatty liver who have received treatment in the drug taurine in a dose of 250 mg 2 times a day for 3 months. The control group consisted of 10 children 1-2 groups of health. Criteria for diagnosis of fatty hepatosis were: primary obesity, the density of the liver F_1 - F_2 (Metavir score) according to elastography, the absence of cytolysis. The assessment of parameters of free radical oxidation (fro) was performed by the method of induced chemoluminescence serum at a biochemiluminometer BLM 3606 M-01 (Russia). Elastography of the liver were performed with the use Fibroscan (France).

Results and discussion

Oxidative stress (high intensity of the processes of FRO at lower values of antioxidant activity (AOA) of the source was recorded in 64,7 % of children of the 1st group and in 69,6 % of children of the 2nd group. On the background of treatment with taurine was a decrease in the chemiluminescent oxidative factor (characterizes the state of oxidative status) in children of the 2nd group in 2,07 times ($p < 0.05$), and the children of the 1st group – 1,23 times. The decrease in the intensity of the processes FRO in the back of an increase in the AOA of serum in the dynamics in children of the 2nd group was accompanied by a reduction in the density of the liver (kPa) according to elastography in 1,38 times ($p < 0.05$). Positive changes in the echostructure of the liver in children with fatty liver during therapy with taurine was confirmed by the decrease in the frequency registration stage F_2 according to elastography in 3,49 fold ($p < 0.05$). Significant differences in the change of echostructure of the liver according to elastography in children of the 1st group have been identified. Therapy taurine in children of the 2nd group recorded significant decrease in the frequency of registration of complaints of pain in the right hypochondrium, tenderness on palpation of the liver. Thus, the use of taurine in children and adolescents with steatosis was accompanied by normalization of clinical symptoms on a background of reducing oxidative stress and improving the echostructure of the liver according to elastography.

Conclusion

Metabolic therapy with taurine should be recommended for the prevention of disorders of oxidative status and risk of developing non-alcoholic fatty liver disease in children with primary obesity.

Key words: children, oxidative stress, fatty hepatosis, elastography, taurine

The influence of regional antioxidant therapy on some characteristics of fibrinolytic activity of the blood of patients with purulo-necrotic pancreatic diabetes complications

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Hemostasis system malfunction by way of plasmic system distress plays an important role in the pathogenesis of complicated forms of diabetic foot.

Research objective is to study the changing of a fibrinolytic system activity in case of regional intra-arterial introduction of mexidol to patients with complicated forms of diabetic foot.

Materials and methods. We have examined 60 patients with complicated forms of diabetic foot. Traditional therapy was employed in a control group of patients (30 persons) with a glance to complications and associated diseases. In the main group (30 persons) intra-arterial introduction of mexidol into femoral artery of an affected limb in a dose of 400 mg dissolved by 15 ml of sodium chloride isotonic solution was put into practice one time every day, during the period of 7-10 days against the background of traditional therapy. The activity of fibrinolytic system was estimated according to spontaneous fibrinolysis definition by B.I. Kuznik, euglobulin lysis after artificial contact activation of the factor XII with kaolin (Hageman-factor-dependent fibrinolysis), according to euglobulin lysis by Kowarzik, Buluck before and after compression of a shoulder with a cuff during 2 minutes when the pressure was 10 millimeters of mercury higher than systolic. (V.P. Baluda, 1989).

Blood samples for the research were taken from a vein on a bend of elbow when a patient arrived at a clinic, on the 5th day, 10th-12th day and 20th-22nd day of medical treatment.

Results. When patients arrived at a hospital an apparent depression of lytic activity of the blood clarified itself in the form of 11%-decrease of spontaneous fibrinolysis ($P<0,001$), 69%-decrease of Hageman-factor-dependent fibrinolysis ($P<0,001$) and 25%-decrease of euglobulin lysis ($P<0,01$). Shoulder compression with a cuff didn't activate euglobulin lysis for certain, which indicated that activity of the tissue activator of plasminogen was dramatically depressed.

Despite the adequate traditional therapy conducted in the first group of patients on the 5th day there was a depression of plasmic system that continued up to 20-22 days.

In the second group of patients a certain increase of activity of fibrinolytic system became evident on the 10th-12th day. Spontaneous fibrinolysis was 8% higher ($P<0,001$), Hageman-factor-dependent fibrinolysis and euglobulin lysis –10% ($P<0,001$) and 7% ($P<0,05$) higher respectively.

On the 20th-22nd day in case of intra-arterial introduction of mexidol, in comparison with traditional therapy, spontaneous fibrinolysis was 5% higher ($P<0,001$), Hageman-factor-dependent fibrinolysis was 9% more active ($P<0,001$), euglobulin lysis time was 5% less ($P<0,05$).

Conclusion. Thereby regional intra-arterial introduction of mexidol to patients with complicated forms of diabetic contributes to earlier activation of fibrinolytic system in comparison with traditional treatment.

Key words: diabetic foot, mexidol, traditional therapy, intra-arterial introduction, fibrinolytic system

EFFECT OF OZONETHERAPY ON THE COURSE OF DIABETIC WOUND PROCESS

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One of modern methods, which combines effect on different elements of pathogenesis of diabetic foot and affects the purulent necrotic focus, is medical ozone.

Objective

To study the course of wound process in systemic ozone therapy of purulent necrotic complications of diabetic foot.

Methods

In order to evaluate the effectiveness of ozone therapy we studied 40 patients with type II diabetes mellitus suffering from purulent necrotic wounds.

The patients were divided into two groups of similar severity, degree of diabetes compensation and prevalence of purulent necrotic processes. 20 patients were in control group and 20 were in main group. Complex treatment was performed taking into account the diabetes mellitus severity, with the necessary condition being the achievement of compensation of hyperglycemia. The local treatment involved active surgical treatment of wound with resection of non-viable tissue, adequate drainage and treatment with antiseptic solutions. In the main group, apart from the above-mentioned treatment, the patients additionally underwent intravenous infusion of ozonized 0.9% sodium chloride solution in volume 400 ml and 2,500 µg/l ozone concentration at exit from ozonizer, for 10 days. Treatment effectiveness was based on term of clearing the wounds from necrotic tissue, manifestation of granulated tissue, start of marginal epithelization of the wound. In order to evaluate the dynamics of the regeneration process in the wound we used cytological study of wound exudates via surface biopsy of the wound.

Results

The term of cleaning the wound from the purulent necrotic tissues in the group of the patients receiving traditional therapy was 15.1 ± 0.6 days. In the patients who underwent additional ozone therapy, the cleaning happened on average 4 days earlier. Hyperthermia and tissues edema around wound in patients in traditional treatment disappeared on day 11.3 ± 0.6 , in ozone therapy – on days 8.4 ± 0.5 .

The manifestation of granulated tissue in the patients who got traditional therapy was on average on day 15.8 ± 0.8 , with infusion of ozonized 0.9% solution – on day 12.5 ± 0.5 . The start of marginal epithelization in traditional treatment was noted on day 26.2 ± 0.8 since the moment of admission, in the patients of the main group it was on average 6 days earlier.

At admission in the smears of the wounds there was noted large amount of coccobacilli flora. The specimen also contained large amount of neutrophil leukocytes, up to 90% from total number of cell elements.

In traditional therapy on day 12-14 there was noted the decreased microbial contamination in the wound exudate. Number of neutrophils was 90%. Microflora was found in cells in moderate amount.

On day 20-24 the number of neutrophils in the wound dropped down to 60%. Cell destruction was found in single cases. Microflora in the wound was absent in 80% of cases. The number of macrophages and polyblasts increased to 10% from cellular amount. The cytological pattern was typical for inflammatory regenerative type of wound process.

On day 12-14 of complex treatment using ozone the cytograms registered the decrease in neutrophils amount to 60%, the number of polyblasts and macrophages was up to 30%. Microflora was observed in small amount in the state of active phagocytosis. By 20-24 days there was a significant development of regenerative processes in the wound. Neutrophils were reduced to 30-40%. The microflora of the virtually non-existent. Dominated by young cells of granulation tissue, profibroblasts and fibroblasts, macrophages. There was a picture of the active boundary epithelization.

Conclusion

Ozone significantly affects the phase course of wound process. In the first phase (cleaning of the wound) ozone leads to earlier stopping of inflammatory process, and in the second phase (regeneration phase) ozone significantly accelerates the process of wound metabolism.

Key words: diabetic foot, ozone, wound process, cytology

The influence of regional antioxidant therapy on wound process of patients with the syndrome of diabetic foot

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Research objective: to study the dynamics of repair processes in a wound when using intra-arterial introduction of mexidol in the course of a multimodality treatment of complicated forms of diabetic foot.

Materials and methods. We have provided the treatment of 60 patients with 2nd type pancreatic diabetes of average severity level complicated by surface and deep foot ulcers without involvement of bone tissue, nonhealing foot wounds after minor amputations on a foot. The age of the patients was from 53 to 74 years, clinical course of pancreatic diabetes – from 3 to 17 years.

The patients were divided into 2 groups comparable in level of severity and diabetes compensation degree and in prevalence of wound defect: the 1st group (30 patients) – a control group in which only traditional therapy was employed with a glance to complications and associated diseases. In the 2nd group (30 patients) the set of remedial measures included intra-arterial introduction of mexidol in a dose of 400 mg once a day during 7-10 days. Before introduction the preparation was dissolved in 20 ml of 0.9% solution of sodium chloride. The efficiency of treatment was estimated clinically by granulation tissue growth speed, marginal epithelization appearance.

The estimation of the repair processes was made on the basis of the data of cytological examination of wound effluent, collected during wound surface biopsy according to the method of M. F. Kamaev (1970). Smears were colored and preserved according to the method of Romanovsky.

Results. The clinical criteria of intra-arterial mexidol in the course of multimodality treatment of complicated forms of diabetic foot were indicative of wound process improvement as in the 2nd group plethoric granulations and marginal epithelization emerged 2, 3 and 4 days earlier than in control group. Before treatment there was a reasonable number of invariable polymorphonuclear leukocytes (15-20 within sight) in the cytogram of wound surface layers. The number of polyblasts and macrophages was up to 1-3 within sight, there was a scanty microflora. There were fibrin strands.

On the 12th-14th day there was up to 8-10 invariable polymorphonuclear leukocytes in sight in cytograms of patients from the group in which traditional therapy was used. The number of macrophages and polyblasts equaled to 7-9 within sight. In the group of patients in which regional introduction of mexidol was added during 12-14 days of treatment the decrease of number of polymorphonuclear leukocytes (3-5 in sight) and the absence of microflora were indicators of favorable wound process. Single macrophages were noticed. The number of polyblasts increased up to 12-15 in sight – single or groups of 2 or 3 cells. A transformation of polyblasts into profibroblasts was noticed which denoted wound repair process activation.

Conclusion. Thereby the data presented give evidence that intra-arterial mexidol introduction employment exert a stimulating influence on repair processes.

Key words: diabetic foot, mexidol, traditional therapy, intra-arterial introduction, wound process

INFLUENCE OF OZONE THERAPY ON POSTOPERATIVE HEMOSTASIS SYSTEM DYNAMICS IN PATIENTS WITH OBSTRUCTIVE JAUNDICE

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The results of treatment were analyzed in 80 patients with obstructive jaundice, which had the traditional therapy (group 1, 44 patients) and the intravenously ozone therapy was applied in the postoperative period (group 2, 36 patients). Ozonized physiological solution at a concentration of 2500 mcg/l was infused over a 10-day of postoperative period. The indicators of the functional state of the liver and hemostasis were determined in plasma of venous blood of patients in both groups by conventional methods.

After the ozone therapy the positive dynamics of the internal mechanism of activation of prothrombin was observed. The active partial thromboplastin time was restored to normal for 5 - 6 days faster in 2 times in comparison with the first group. The concentration of soluble fibrin monomer complexes to 15 days of postoperative period in group 2 remained above 23% compared to the original figures. It was revealed that the normalization functions of hepatocytes and indicators of hemostasis after the ozone therapy was occurred in a shorter time than patients of the first group.

Key words: obstructive jaundice, ozone, hemostasis

VARIANTS OF CLINICAL APPLICATION OF OZONE THERAPY TECHNIQUES IN AMBULATORY PRACTICE OF DERMATOLOGISTS

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Actual learning needs of out-patient reception dermatologist in terms of features of different forms of external appointments ozonide-containing external preparations and their combination with systemic methods of ozone therapy and traditional drug therapy Analysis of the frequency of the appointment methods of ozone therapy on outpatient vracha dermatologist, trichologist in the office, equipped with dermatoscope DermLite, Wood's lamp, trichoskope Aramo-S, the possibility of using microscopic, culture study, PCR - diagnosis, cryotherapy and radio wave therapy with apparatus "Surgitron". Counselling patients conducted in the period from 01.11.2015 till 05.01.2016 year (6 months), treated 213 patients aged 1 year to 80 years, mean age was 24.7 years in the structure of morbidity and prevailed allergodermatoses dermatosis of infectious origin. 35 patients (16%) were appointed by different methods of ozone therapy as a component of comprehensive treatment: as a means of local production Medozons TEAP used drugs, Nizhny Novgorod. Assigns the following techniques: oil applications of 12 000 (5), oil of 6000 (11) Cream 2000 (moisturizing) (9) Cream 2500 (Foot) (7), cream cellulite 3000 (1), Mask Hair Cream 1500 (3) intravenous drip infusion ozonated saline solution (9), the ozone chamber (2), drinking ozonated water (5), thus the most widely used method of systemic ozonoterapii were infusion ozonated saline and local drug - oil with a peroxide value 6000 and creams 2000 and 2500. The ozone therapy methods have proven most popular with common diseases in ambulatory practice of the trichologists and dermatologists.

Key words: ozone therapy, dermatology

The analysis of interaction of ozone and sodium chloride in Aqueous solution

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This paper contains the analysis of published reference data related to the ozone and NaCl interaction in aqueous solutions with different content of NaCl (0.9%; 1%, 3%, 5% and 10%) therein and their bubbling by the ozone-oxygen gas mixture with the ozone concentration ranging from 10 to 100 mg/l within 10 to 120 minutes.

The authors of the papers under study by using the protonography, chemical and spectrophotometric and research methods identified in ozonated solutions potentially possible products of the ozone and sodium chloride reaction in water: hexagonal aqueous structure, sodium hypochlorite, hypochloric acid, chlorates (ClO^- , ClO_2^- , ClO_3^-), nitrite, nitrate (NO_2^- and NO_3^-), free radicals, hydrogen peroxide as well as dissolved ozone and oxygen.

From the performed analysis of published reference data it follows that when treating these solutions with the ozone-oxygen gas mixture and in the subsequent disintegration of ozone therein, the latter interacts neither with Na^+ nor with Cl^- ; sodium hypochlorite and other chlorine-containing oxygen ions, nitrates and nitrites are not formed herewith. There are identified dissolved oxygen and ozone and in the interaction of the latter with water free radicals, hydrogen peroxide, hexagonal and low-molecular aqueous structures are generated.

Key words: products of the ozone and sodium chloride interaction in aqueous solutions

Specialties of crystallogenic activity of ozonized sodium chloride solutions

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The **aim of the study** was the analysis of the results of crystalloscopic study of ozonized solutions, depending on exposure and concentration of ozone in ozone-oxygen gas mixture.

Material and methods

In a container with a capacity of 500 ml physiological solution was sparged with ozone-oxygen mixture with ozone concentration 5, 10, 40, and 60 mg/l for 10, 15, 30, 45 and 60 minutes. (UOTA-60-01 device, "Medozon", Russia) On the stages of controlling time took the ozonized solution was measured and its content of dissolved ozone on the same machine. At the same time on a clean, fat-free glass was applied 100 mcl of the ozonized solution relating to each series of experiments, as well as saline prior to ozonation (intact sample). Dehydration of the drops of saline solution was performed in the laboratory conditions without additional thermal stimulation. The duration of dehydration was 24 hours. Viewing and photographing facies was carried out on a measuring microscope "Hawk" (UK) and an automated microhardness tester "VMHT AUTO MOT" (Germany).

Analysis of the crystallograms carried out on the basis of the morphology of the formed phases, as well as visualations using its own system of criteria-based assessment.

Results

Our crystalloscopic study of ozonized solutions confirms the formation of small-molecule structures in water is ozonized physiological solution. The treatment of the latter with gaseous ozone significantly transforms the result of its crystallization, and the severity and direction of this modulation of the nonlinear effect depends on ozone dose and duration of processing. In turn, this fact may indicate a modification of the physico-chemical properties of the studied solution and, hypothetically, a change in its "information load".

Key words: saline, ozone, crystallization

The use of ozone therapy in the treatment of leukoplakia vulva in women

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Leukoplakia of the vulva is a chronic degenerative process of the mucous membrane of the vulva associated with keratinization (cornification) of stratified squamous epithelium, which occurs mainly in the elderly.

The purpose of research: to evaluate the effectiveness of the use of medical ozone in the treatment of leukoplakia of the vulva in postmenopausal women.

Materials and methods

The study involved 155 women with leukoplakia of the vulva. The first group consisted of women who got ozone therapy besides the drug therapy (n = 75), the second group included patients, who only got the traditional medical therapy (n = 80). Ozone therapy was carried out by ozone therapeutic installation with ozone destructor Wat-60-01- "Medozon" through day intravenous drip infusion of saline 0.9 200.0% for 20 minutes at a speed of 8-10 ml / min with a concentration of ozone in solution 4.0-4.5 mg / l, 5-6 procedures per course. Parenteral administration is accompanied by local irrigation perineum, vagina and vulva ozonated saline solution with ozone concentration of 9-10 mg / l, a course of 5-6 treatments every other day. Local treatment continued with "ozonide" ozonated oil for a long time. To evaluate the effectiveness of rehabilitation measures groups of patients were similar in their clinical characteristics.

Results and discussion

All women (100.0%) complained of pain, a feeling of dryness, tension and tightening of skin and mucous membranes of the vulva. At gynecological examination in all (100%) revealed the characteristic whitish lesions and multiple scratches on the mucosa of the vulva. We have excluded dysplastic processes, cancer of the vulva and vagina. After the first treatment of ozone therapy 98% of women of the first group noted an improvement in well-being and normalization of sleep; 85% - reduction in the severity of symptoms of itching and pain in the pathological process. After the third treatment 95% of women noted relief of pain and improvement of appetite. Good results gave prolonged topical application of oil "ozonide" on the affected area of up to 5 times a day every day. The duration of remission in leukoplakia of the vulva lengthened to an average of 5-6 months, and in some patients (25%) remission was 1 year or more.

Thus, the use of ozone therapy in treatment of leukoplakia of vulva is useful for menopausal women, it helps to achieve significant remission of the disease, and in some cases even to achieve complete remission of the disease.

Key words: ozone, leukoplakia vulvar lichen sclerosus of the vulva, chronic degenerative disease of the vulva, menopause

THE USE OF MEDICAL OZONE IN COMPLEX TREATMENT WOMEN WITH FETAL GROWTH RETARDATION

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Complete medical therapy does not always provide desired results of treatment of fetal growth retardation in pregnant women because the possible development of intolerance to drugs, lack of effectiveness of the dose can lead to the limitation to the possibility of using of drugs. So the growing attention of clinicians to non-drug treatments, one of which is ozone, is explainable.

The purpose of research

to evaluate the effectiveness of the use of medical ozone in complex treatment of women with fetal growth retardation.

Materials and methods

Under our supervision there were 50 women, coming in maternity hospital in the period 26-39 weeks of gestation, who revealed the intrauterine fetal growth retardation by the ultrasound examination. Depending on the nature of the treatment carried out patients were randomly distributed in two groups of observations. The first group (n = 24) included women who received the comprehensive treatment in addition with ozone therapy, the second included the patients, who only got the traditional medical therapy (n = 80). Ozone therapy was conducted in a day by intravenous drip infusion of saline 0.9 200.0% for 20 minutes at a speed of 8-10 ml / min with a concentration of ozone in solution 0.4 mg / l, 5 treatments per course. Ozone treatment of saline was administered with the help of ozone therapeutic installation with ozone destructor Wat-60-01- "Medozon" (Moscow, Russia). To evaluate the effectiveness of rehabilitation activities we have taken groups of patients, similar in their clinical characteristics.

Results

The inclusion of medical ozone into complex treatment of women with fetal growth retardation promoted favorable course of childbirth, less complicated discoordination labor (7.8% and 33.3% respectively, $p < 0,05$). The assess of the state of newborns showed that children in patients after combined treatment with ozone therapy were born with less signs of severe asphyxia (Apgar 3 and <points) (7.7% and 33.3% respectively, $p < 0,05$), and cerebral ischemia of I degree (7.7% and 50.0%, respectively, $p < 0,001$). Thus, the use of medical ozone in complex treatment of women with intrauterine fetal growth retardation is more efficient than the conventional therapy.

Key words: ozone therapy, fetal growth retardation, newborn

Ozonization STATION of "TEOZON" TYPE

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At RFNC-VNIIEF an ozonator was designed with the ozone generation capacity 8 g/h and a local water treatment plant based thereon with the water treatment capacity 5 m³/h. Such ozonator may be used, if necessary, in the set of an ozone plant of modular construction with the ozone generation capacity 100 g/h, which is quite enough to treat 60 m³/h of water. The plant provides for water ozone treatment in compliance with state standard and sanitary norm requirements regulating the quality of drinking water and return water in swimming pools.

Key words: decontamination, water treatment, ozonation

THE APPARATUS FOR NO INHALATION THERAPY

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The paper presents the description of the apparatus for NO inhalation therapy. The apparatus has no analogues in the world and provides the synthesis of nitric oxide directly during inhalation. The introduction of the plant will allow to refuse the use of cylinders with a NO, which will reduce the cost of therapy and increase its availability.

Key words: apparatus for NO-therapy, nitric oxide inhalation

ROLE OF OZONE IN CHANGE OF NA-K-ATPase ACTIVITY AND CONTENT OF ATP AND 2,3DFG IN ERYTHROCYTES BY MODELING ACUTE BLOOD LOSS AT RATS

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The **aim of this work** was to study the dynamics of changes in the activity of Na-K-ATPase and the concentration of organic phosphates in the erythrocytes of rats after the transfusion of ozonated erythrocyte mass in acute blood loss.

The study was conducted on 20 nonlinear rats. Animals were divided into 2 groups of 10 animals in each group. Blood loss rats were created by sampling 3 ml of blood from the tail artery. After an hour, the blood loss was compensated by the introduction of Packed red cells (washed erythrocytes of the same animal, taken 3 days prior modeling of blood loss) with physiological saline. Rats of the 1st group were administered 0.5 ml of the washed erythrocytes and 2 ml of ozonated physiological solution. Rats of group 2 (control) were administered 0.5 ml of the washed erythrocytes and 2 ml of saline. Ozonized physiological solution contained 2 mg/l of ozone. The ozonized physiological solution produced immediately before its introduction into erythrocyte mass to install ozone therapeutic automatic WAT-60-01-“Medozon” (Russia). Blood sampling for analysis was performed after 1 hour, 1 and 5 days after modeling of blood loss. Evaluation of systemic effects of the obtained erythrocyte suspension on the indicators of 2,3-DPG and ATP in the suspension of washed erythrocytes was investigated non-enzymatic method. The activity of Na,K-ATPase of erythrocytes was estimated by the increase of inorganic phosphate, inorganic phosphate was determined spectrophotometrically.

Analysis of the results revealed that the hemorrhage in rats nabludaetsya the activity of Na⁺-K⁺-ATPase in erythrocytes, accompanied by a reduction in the concentration of ATP and increasing the concentration of 2,3 DPG. Probably, the revealed changes of the studied indicators is due, on the one hand, the development of compensatory processes aimed at the elimination of hypoxia, loss of blood, due to the increase in the concentration of 2,3 DPG reduces affinity of hemoglobin for oxygen, on the other hand, the decrease of concentration of ATP – factor short-term regulation of the activity of Na-K-ATPase, leads to a decrease of the enzyme activity. The use of ozone determines the increase in the activity of Na⁺-K⁺-ATPase. With the increase in the activity of Na⁺-K⁺-ATPase involves transport of substrates of cell activity, in particular of glucose. It also improves the metabolism of red blood cells and increases the content of ATP and 2,3 DPG in erythrocytes.

Thus, the use of ozonated erythrocyte mass in its transfusion of rats with acute blood loss made it possible to optimise the oxygen-transport function of erythrocytes. It proves a pathogenetic rationale for the use of ozone for the correction state of the organism in acute blood loss.

Keywords: Na-K-ATPase, ATP 2,3DFG, ozonatederythrocyte's mass, blood loss

THE EVALUATION OF BLOOD OXIDATIVE STATUS UNDER THE INFLUENCE OF REACTIVE OXYGEN SPECIES IN THE EXPERIMENT IN VITRO

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Under lowered contents in the atmosphere of superoxide radicals animals and people sick, and prolonged their absence die. One of the most known and used in medicine from free radicals are ozone (O₃), singlet oxygen (O₂'), and nitric oxide (NO). The aim of this work was to study the effects of different concentrations of active forms of oxygen (O₃, O₂') and NO on change of oxidation-reduction potential (ORP), pH, indicators of pro- and antioxidant protection of blood in vitro.

Material and methods

Experiments were conducted on blood from patients-donors. The processing of blood was carried out by direct sparging by gas mixture for 2 minutes. We used 100 ppm NO, O₃ in dose – 500 mcg, power gas flow O₂'-100%. We measured the activity of superoxide dismutase (SOD), pH, ORP, indicators of lipid peroxidation (LPO), total antioxidant activity (TAA) of blood plasma, peroxide resistance of erythrocytes (PRE), the level of malonic dialdehyde (MDA).

Results and discussions

It was shown that under the impact of O₃, O₂' and NO on conserved blood have been statistically significant changes in ORP with the shift of pH to the alkaline side. Under the impact O₃ in blood was observed the increase in the intensity of LPO in the plasma in 1.51 times, the decrease of SOD activity in 1.1 times, the increase in MDA in the blood plasma in 4.14 times and in erythrocytes in 1.33 times, PRE decreased to 1.23 times. The processing of donor blood by NO and O₂' intensified to her LPO to a lesser extent than ozone. After the impact of NO and O₂' the increase of the LPO was in 1.22 and 1.26 times. Under the influence of NO the level of MDA in plasma was increased in 3.56 times, in erythrocytes – in 1.86 times. When exposed to O₂', the concentration of MDA increased by only 1.49 times in the plasma and by 1.43 times in erythrocytes. SOD activity was higher by 1.13 times.

Conclusion

The results of the experiment showed that after the impact of all the studied ROS and NO in blood pro- and antioxidant systems in vitro intensify with clear development of the phenomena of oxidative stress (using ozone). The degree of manifestation of the resulting changes, apparently, is determined by the number used bioradicals has its similarities and differences depending on their type.

Key words: ozone, singlet oxygen, nitric oxide

PHYSICO-CHEMICAL PROPERTIES OF CANNED BLOOD AFTER THE IMPACT OF REACTIVE OXYGEN SPECIES

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Lately wide distribution has training methods of the antioxidant system through a moderate ROS generation, leading to higher capacity of the antioxidant defense system, its adaptation and biostimulation. The aim of the work was to study the effects of ozone (O₃), singlet oxygen (O₂[']), nitric oxide (NO) on the modification of some physical and chemical parameters, the activity of lactate dehydrogenase (LDH) in the direct and reverse reaction in blood in vitro.

Material and methods

In the experiment in vitro the direct sparging of blood samples from patients-donors by gas mixture for 2 minutes were produced. It was used 100 ppm NO, O₃ in dose – 500 mcg, power gas flow O₂'-100%. We measured the activity of lactate dehydrogenase in direct reaction and in the reverse reaction, physico-chemical parameters of blood – pH, pCO₂, pO₂.

Results and discussions

When the sparging blood of the ROS there was a strong oxygenation in blood: indicator pO₂ increased when exposed to blood O₃ in 4.11 times, under the influence of NO – in 1.53 times; when exposed to O₂' in 2.43 times. It was shown that the impact O₃ decreases pCO₂ in 3.15 times, when exposed to NO pCO₂ reduces to 3.34 times, when exposed to O₂' decreases pCO₂ in 3.28 times.

There was a statistically significant decrease in glucose levels when exposed to donor blood by O₃ to 1.20 times, NO – in 1.44 times, O₂' – in 1.24 times, respectively. When exposed to O₃ an increase in lactate level in 1.34 times was been. There was an increase in the activity of LDH in reverse reaction under the increase of activity of LDH in direct reaction. The same trend can be seen when exposed to NO. The lactate level increased in 1.29 times. The activity of LDH in direct reaction increased 1.37 times, and LDH in reverse reaction – in 1.81 times. Under the influence on conserved blood O₂' a lactate level increased in 1.24 times. The activity of LDH in reverse reaction increased to 1.50. times.

Conclusion

Thus the oxygenation of blood in the background of metabolic alkalosis was seen under the influence of reactive oxygen species and nitric oxide in vitro. The decrease of glucose in blood was marked under the influence of all ROS. However, the level of lactate increased due to the prevalence of LDH activity in reverse reaction over the direct reaction.

Key words: ozone, singlet oxygen, nitric oxide, lactate dehydrogenase, glucose

The role of oxidized albumin in erythrocyte aggregation

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We studied the influence of albumin oxidation rate on aggregation and disaggregation of erythrocytes.

The study was conducted on 20 blood samples of healthy people. The blood was taken into vacuum tubes (BD Vacutainer) to obtain serum. After 30min the blood was centrifuged 10 min at 1700g. For the study of aggregation of erythrocytes we used blood stabilized with 3.8% sodium citrate solution (9:1). Spontaneous aggregation of erythrocytes was studied in an artificial shear flow on the device of own design (patent No. 2278381), which used a principle proposed by H. Schmid-Schönbein et. al. (1973) with registration process on the recorder. The albumin solution (5%) was subjected to UV-irradiation for oxidative modification. The monitoring of oxidative modification of albumin was performed according to the method of R.L. Levine et.al. in modification of E.E. Dubinina et al. Each series of experiments with albumin of different oxidation was carried out on the blood of one donor.

The changes in red blood cell aggregation associated with oxidation rate of albumin were found. Possible mechanisms of these effects are investigated.

Key words: oxidized albumin, erythrocyte aggregation

Experience of application of medical ozone in the complex therapy of placental insufficiency

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Despite significant advances in prevention and treatment, the problem of chronic placental insufficiency (PI) has not lost its relevance and continues to be one of the priorities in modern obstetrics.

Objective: to improve the treatment of placental insufficiency with the use of plasmapheresis and medical ozone to reduce obstetric complications and improve perinatal outcomes.

Surveyed 127 pregnant women in pregnancy weeks 24-28 with compensated or subcompensated placental insufficiency, established on the basis of clinical and laboratory data, results of ultrasound, Doppler parameters. The main group consisted of 58 pregnant women with PI, in the complex treatment which, in addition to conventional therapy, were included treatments of plasmapheresis in combination with medical ozone. The comparison group consisted of 69 women with PI who underwent traditional treatment. In studying the effect of various types of PI therapy revealed a significant decrease in the level of middle molecules and TBA-products in the blood serum of the patients of the main group. The analysis of indicators of gemostaziogramma has revealed pronounced positive effect of plasmapheresis in combination with ozone therapy on fibrinogen, APTT, thromboelastography, D-dimer.

The concentration of angiogenic growth factors – the PGF and VEGF in the serum before treatment in both groups was comparable. After treatment with various methods, in the main group, the median concentration of as VEGF, and PGF was 1.6 times higher than in the comparison group, which may be explained by activation of angiogenesis in the group with the inclusion of plasmapheresis in combination with O₃. Assessment of the degree of development of the vascular network in the placental villi after conducting of various therapy showed a significantly greater number of placentas with good vascularization in the main group – 72%, in contrast to the comparison group – 48%. Comparative assessment of the level of the PGF in the placenta showed significantly greater concentration in the main group in contrast to the comparison group.

Analysis of the course of labour in patients with placental insufficiency showed that spontaneous delivery occurred in 60% women of main group and in the comparison group – 45%. The frequency of preterm birth in the main group amounted to 14%, which was significantly lower than in the comparison group – 30%. A comparative analysis of the structure of the pathology of the early neonatal period show that pre-natal infection of the fetus and the implementation of infection and fetus growth retardation significantly less frequent than were observed in children from mothers of main group, who received treatment with use of plasmapheresis and medical ozone.

Thus, timely diagnosis of placental insufficiency and comprehensive treatment of PI with use of plasmapheresis and medical ozone allows to reduce the frequency of preterm birth, fetus growth retardation, and birth of children with anaemia, asphyxia and infection.

Key words: pregnancy, placental insufficiency, plasmapheresis, ozone therapy, angiogenic factors, efficiency

INVESTIGATION OF NITRIC OXIDE ROLE IN RETENTION OF LONG-TERM MEMORY UNDER RECONSOLIDATION IN TERRESTRIAL SNAIL

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In present nitric oxide (NO) is considered as a new signal molecule that plays the role of a universal regulator of many physiological processes in the body. NO-synthesizing neurons found in the nervous system of invertebrates, including mollusks. It was found that NO is involved in behavioral programs and in activation of the synthesis of cGMP. More and more data is accumulating that in the nervous system NO is involved in the development, maturation and aging of the brain, in the processes of learning and memory. The problem of the mechanisms of learning and memory is always an important step in the preservation of results of learning. Stage of long-term memory, well may test via the process of reconsolidation of memory. It has been shown that happen the amnesia of memory, if consolidated and stable long-term memory will be reactivated prior to amnesic treatment. To present time formed the following view on the mechanisms of learning and memory: there are long-term processes of memory formation and they are associated with new protein synthesis, but there are the processes, which is shorter and they are associated with the covalent modification of existing proteins in pre- and post-synaptic structures. It therefore seems an actual task the study of the role of NO in the formation and reconsolidation of long-term memory.

For the experiments as an object was selected the terrestrial snail *Helix lucorum*. The procedure of elaboration of environmental reflex (ER) was performed in standard conditions, when the shell of a snail rigidly mounted to the tripod, and the snail crawling freely over a ball floating in the water. After testing began learning procedure, while snail within 5 days received 5 electrical stimulations per day (1-4 mA, 1C., 50Hz) via the touch of two microelectrode dorsal to the dorsal part of the foot and to the tail. During test of defensive behavior of animals it was measured the amplitude of retraction of ommatophores in response to tactile stimulation of the foot. Testing of behavioural reactions were performed: 1) on the ball (i.e., standard conditions), 2) on a flat surface of the lid of the terrarium (i.e., under conditions different from the standard). On the next day, after testing confirming the production of ER, snails were placed in 20 minutes on the ball that served as a reminder of ER, and then blocked the biosynthesis of protein by injection of anisomycin (AN) of "Sigma" in a dose of 0.4 mg per snail. There were used the inhibitors of NO-synthase (NOS) L-NAME at a dose of 100 mg/kg of body weight; 7-nitroindazole at a concentration of 10⁻⁴ mol/l; aminoguanidine at a concentration of 10⁻⁴ mol/l. All preparations of "Sigma".

It is shown that application of inhibitor of protein biosynthesis AN after session of reminders environment leads to the reconsolidation of long-term memory. Injection of sodium nitroprusside did not cause changes in elaboration of ER relatively injections of saline solution but non-specific inhibitor of NO - synthase L-NAME prevented the learning. Also, we have found that L-NAME and 7-nitroindazole greatly reduces the reconsolidation of long-term memory after the formation of ER. At the same time, the inhibitor of inducible NO- synthase, aminoguanidine did not affect on the process of reconsolidation. Thus, in these experiments we have shown that NO is necessary for learning (generation of ER), and for the preservation of long-term memory.

Key words: nitric oxide, learning, long-term memory, reconsolidation of memory, inhibitors of NO-synthases

The functional changes of enzymatic activity and substrate support, caused by local application of creams with different concentration of ozonides

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Ozonide-containing creams and oils designed for the targeted elimination of cosmetic skin defects, are increasingly used in cosmetics. The aim of this study was the experimental evaluation of the effects of local application of cosmetologic creams with different concentration of ozonides on the enzymatic activity and substrate support of energetic processes.

Material and methods

The experiment was conducted on Wistar rats. The duration of experiments was 10 days. The cream "OZODERMIS" containing 3%, 5% or 10% ozonides was applied daily on animal depilatory area of the skin of the back in the area of 10% of body. For the study of enzymatic activity and substrates we used blood stabilized with sodium citrate. The concentration of glucose and lactate was measured on the apparatus Super GL ambulance (Germany) in plasma and erythrocytes. In the hemolysate of erythrocytes (1:40) we evaluated the activity of aldehyde dehydrogenase and lactate dehydrogenase with the substrate of lactic acid. The activity of superoxide dismutase was determined in the hemolysate of erythrocytes (1:10) on the inhibition of formation of product autooxidation of adrenaline. Statistical data processing was performed using Statistica 6.0.

The results and discussion

Using an animal model (rats), we showed that local application (for 10 days) of creams, containing different concentrations of ozonides (3%, 5% and 10%), has a dose-dependent effect on the activity of the oxygen metabolism in blood. The use of the 3% cream was found to be most optimal. The application of this preparation resulted in maximum positive activation of the enzymes of the energetic and detoxication lines and led to activity of superoxide dismutase. The simultaneous increase of glucose concentration and the decrease of the levels of lactate in blood plasma and erythrocytes were indicative of activation of energy production in tissues.

Conclusion

Thus, biochemical studies of the reactions of the blood with regular skin application of gel-cream with reactive oxygen species indicated about the inclusion in the system compensatory reactions of a number of systems associated with oxygen homeostasis. It determines the prospects of the use of cosmetic products containing active oxygen in the form of ozonides for the eliminate cosmetic defects.

Key words: ozone, enzymes, energetic substrates, cosmetology

FIRST EXPERIENCE OF COMBINED TREATMENT OF CHRONIC NONSPECIFIC ENDOMETRITIS WITH OZONE AND BACTERIOPHAGE THERAPY

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Introduction

In nonobstetric population chronic endometritis of unidentified etiology can be seen in one third of patients. Chronic endometrial inflammation is one of the causes of the female infertility, miscarriages and unsuccessful attempts of ART. The routine antibiotic therapy of this condition is by no means always effective. Based on the existing data on curative effects of the medical ozone and of bacteriophages, we decided to evaluate the appropriateness of the combined use of these two therapeutic factors.

Materials and Methods

In this research, 60 patients with histologically verified chronic nonspecific endometritis were examined. The participants were women of child-bearing age of 22 to 42 years old, the average age of all examined patients being 28,2±1,1 years old. Impairment of reproductive function, namely infertility, miscarriages and unsuccessful attempts of IVF and embryo transfer, was noted in the anamnesis of all the patients. It should be mentioned that in 90% of patients concurrent or prior infectious and inflammatory processes of different localization (colpitis, bacterial vaginosis, pyelonephritis, cystitis, colitis, tonsillitis, sinusitis) were also documented. Studies of endometrial microflora showed that in 78.6% of the cases microbial associations were detected; these were mainly comprised of potentially pathogenic microorganisms: Staphylococcus, Enterococcus, E. coli, Streptococcus, Klebsiella, Actinomyces, Peptostreptococcus, Clostridium. As per the antibiograms, the microorganisms were either resistant or barely sensitive to the main groups of antibiotics in 36% of cases.

In the main group of patients the ozone therapy consisted in the intra-uterine instillations (400ml) of ozonated normal saline (with ozone concentration in ozone/oxygen mixture of 5000 mcg/l at the generator's output). The procedure was carried out in aseptic conditions.

In addition, at the end of the ozone procedure polyvalent bacteriophage preparation (4-7ml, №5) active against 8 probable, potentially pathogenic organisms that can cause inflammatory process in the endometrium were instilled into the uterine cavity. A tampon filled with the same preparation was inserted in the posterior vaginal fornix for 3 to 4 hours to prevent leakage of the medication and allow for full implementation of its antimicrobial action on the vaginal mucosa.

Prior to and following the therapy microbiological and immunological status of the patients was evaluated. Bacterioscopy, vaginal, cervical and uterine cavity cultures, STD testing, as well as determining the levels of CD3+, CD4+, CD8+ and of the circulating immune complexes in blood were done. The concentration of the anti-inflammatory interleukin-6 in cervical mucus was also tested.

Results and Discussion

No adverse effects or complications were noted during or after the procedure. After a month of combined treatment pathological vaginal discharge disappeared, vaginal microbiocenosis normalized and endometrial cultures became sterile. Cervical secretions showed a decrease in the level of IL-6 by 54,8%. Conventional therapy did not have any vivid effect on the investigated parameters. Normocenosis was registered in 86% patients with ozone-plus-bacteriophage therapy compared to 37% women with conventional treatment.

Conclusion

Combination of ozone and bacteriophage therapy as a complex anti-inflammatory treatment was found to produce a pronounced local effect (sanitation of endometrium, normalization of the vaginal flora and immunity indices).

We suggest this method can have good prospects for the treatment of chronic nonspecific endometritis.

Key words: chronic endometritis, ozone therapy, bacteriophage

CRYO OXYGEN AND CRYO OZONE OXYGEN CONDENSATION AS NEW TECHNIQUES OF OXYDATIVE THERAPY

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This paper shows based on the performed physical experiments qualitative chemical reactions and methods of analytical chemistry that by passing air through the cryogenic unit INEY due to its design features liquefied oxygen is condensed on the applicator and by passing the gaseous ozone-oxygen mixture the liquefied ozone-oxygen mixture is condensed. By using the method of biochemiluminescence there has been revealed the interaction of liquefied oxygen and liquefied ozone-oxygen mixture with the biological object (plasma) accompanied by the activation of free radical oxidation. The results of the performed study enable to conclude that cryo oxygen and cryo ozone oxygen technologies are a new trend in oxidative therapy. The difference of these technologies from cryo therapy is in the use of liquefied oxygen or liquefied ozone-oxygen mixture as active cooling agent instead of liquid nitrogen.

Key words: cryo oxygen and cryo ozone oxygen therapy

The radiation of a low ionized plasma spark discharge for the study of biological objects

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Work is devoted to studying of the properties of chemical active species generated in the water by the radiation of a low ionized plasma spark discharge. As plasma is low ionized, the only active factor is plasma radiation. Energy conservation law allows the formation in water under pulse radiation radicals HO_2^\bullet , atoms O^\bullet and molecules N_2O . Secondary active species are nitric and nitrous acids, peroxyxynitrite and peroxyxynitrous acid. Under radiation it was investigated the fluorescence of tryptophan, tyrosine and phenylalanine, and redox processes in albumin. After treatment of albumin the concentration of $-\text{SH}$ groups was found to increase. The increasing of $-\text{SH}$ groups concentration is related to reduction of disulfide bonds in albumin. We have studied the effect of plasma radiation on amino acids and albumin. It was stated in this process the carboxyl group $-\text{COOH}$ and amino group NH_2 are not damage. It destroyed only amino acid radical R. As a result, low-molecular products accumulate which give an absorption peak in the UV spectrum at wavelengths 220 – 230 nm.

Key words: low ionized plasma, biological effects

Additional possibility of Fenton reaction for evaluation of albumin and hemoglobin oxidation ability

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The chemiluminescence induced by Fenton reaction allows detecting reaction products, but not radicals. Fenton reaction can take place in any substratum. Value of chemiluminescence's light sum in Fenton reaction is determined by reactions rate constants of all stage chain oxidation: initiation, propagation and termination of chain. The increasing or decreasing of luminescence light sum means a difference in these constants but not means the antioxidant activity. It doesn't mean the termination of chain reaction with stable products formation. Therefore, according to value of chemiluminescence's induced in Fenton reaction we can evaluate the capability of substratum to oxidation for given conditions. The light sum in Fenton reaction is the capability of substratum to oxidation and it is not proportional to antioxidant activity of sample.

Key words: chemiluminescence, Fenton reaction, radicals detection

Immunorehabilitation patients with bronchial asthma a low pass pulse magnetotherapy

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Introduction

The primary goal in the treatment of bronchial asthma is to achieve the most complete and prolonged remission. To reduce the number of drugs topical application of complex treatment in combination with physical therapy techniques. In recent years, in medical practice widely used method of low-frequency pulse magnetotherapy.

Purpose of the study

To assess the effects of low-frequency pulsed magnetic therapy on the immune status of patients with bronchial asthma.

Materials and methods

The material of the study is based on survey data of 60 patients aged from 18 to 45 years diagnosed with asthma mild, partly controlled flow. Patients were divided into 2 groups: group 1 (n = 30) received basic medication mometasone furoate; Group 2 (n = 30) received basic medical therapy and magnetic therapy. The course of treatment was 10 procedures. Evaluation of the immune status of the study included the parameters of cellular and non-specific parts of the immune system.

Results of the study

After a course of combined treatment with the use of magnetic therapy noted positive dynamics of clinical symptoms in all patients was stated improvement in general condition, reducing the symptoms of respiratory discomfort, no more need for β 2-agonists short-acting, increased all studied lung function. On admission, patients in both groups there was a reduction of the absolute and the percentage of lymphocytes. After treatment, the patients in group 2 changed ratio of subpopulations of T cells: decreased levels of CD 4 + lymphocytes and increased expression of receptors CD 8 + lymphocytes, immunoregulatory index normalized CD4 / CD8, the tendency to increase the overall percentage of phagocytic cells, which confirms immunomodulatory effects of the proposed tactics of magnetic therapy.

Conclusions

The use of low-frequency pulse magnetic therapy in the treatment of patients with asthma has a positive effect on the course of the disease, improves parameters of external respiration and normalizes indices of cellular immunity, enhances phagocytic activity of neutrophils. Known effects of low-frequency pulsed magnetic therapy justify its application in the complex immunorehabilitation patients with bronchial asthma.

Key words: magnetic therapy, asthma, immune system

The Specialties of nitric oxide metabolism in children with gastroenterological pathology

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Introduction

Results of various studies illustrates an important role of nitric monoxide (NO) in pathogenesis of different gastroenterological diseases. In particular this substance is characterized as cytoprotector for gastrointestinal mucosa. In opposite, NO has a damaged activity, is realized through peroxy-nitrite generation.

These conflicting reports are in pediatric practice too, and it is important to study the role of nitric oxide in the pathogenesis of gastrointestinal diseases in children, which was the purpose of the work.

Material and methods

The study included 178 children, including 40 healthy children (control group), 72 children had Crohn's disease (main group 1), 31 - with chronic gastroduodenitis (main group 2) and 35 – with gastroesophageal reflux disease (main group 3).

All children have received blood samples to estimate the total level of terminal products of NO metabolism (concentration of nitrite- and nitrate-anions in the blood serum). Estimation of nitric oxide derivatives was performed by a colorimetric method using Griess reagent by the method of V. A. Metelskaya.

The obtained data were statistically processed in the programme package Statistica 6.0.

The results and discussion

On the basis of the conducted researches it is established that as the concentration of the main end products of metabolism of nitrogen oxide in blood serum of children and their total amount are the differences between healthy and suffering from diseases of the gastrointestinal tract in children.

While the general trend of the studied parameters is increasing, but the severity of these changes varies. The most significant increase in the level of the terminal metabolites of nitric oxide is registered at gastroesophageal reflux disease (GERD), which noted almost twice the proportional increase of nitrate - and nitrite-ions, and their total level. Also proportional, but less significant (an increase of 1.33-1.42 times) the shifts of these indicators identified in children with gastroduodenitis, which may indirectly indicate a less pronounced stimulation of production/release from depositing compounds of nitric oxide in this disease compared with GERD.

Special dynamics of the level of the terminal metabolites of nitric oxide detected in Crohn's disease. In this case, there is a significant increase in their total concentration, a statistically significant excess identified in duodenitis ($p < 0.05$), and it is implemented solely by sharp (1.97%; $p < 0.001$) increase in the number of nitrate ions in the blood serum of children. This pattern may be due to parallel formation of oxidative stress with the rapid increase of the concentrations of reactive oxygen species in serum and increased conjugation of the last metabolism and nitric oxide. It may be accompanied by induction of free radical processes with the prevalent transformation of excess NO in the nitrate anions.

Conclusion

Thus, our study allowed to confirm the presence of significant changes of NO metabolism in blood serum of children with diseases of the gastrointestinal tract, and they can be specific, reflecting the peculiarities of pathogenesis of a particular disease. Therefore, assessment of other elements of metabolism of nitric oxide in the diseases is able to significantly supplement their pathogenesis.

Key words: nitric oxide, gastroesophageal reflux disease, Crohn's disease, chronic gastroduodenitis

The influence of dalargin on free radical processes in brain of rats

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The work is devoted to study the effect of hypothermia and dalargin on intensity of the oxidative modification of lipids and proteins from rat brain synaptosomes. The experiment was carried out on white Wistar rats weighing 180-220 g. The temperature of body was lowered by external cooling to 30°C. The intensity of lipid peroxidation was assessed by analyzing the concentration of malondialdehyde, while proteins oxidative modification - of carbonyl groups. In animals with hypothermia showed increase markers of lipid peroxidation and proteins oxidative modification of synaptosomes. It is found that the preliminary injection of dalargin in a dose of 0,1 mg/kg leads to a decrease in the intensity of free radical processes in synaptosomes during hypothermia.

Key words: hypothermia, synaptosomes, malondialdehyde, carbonyl groups

PHLEBOTROPIC ADJUVANT REGIONAL OZONE THERAPY OF LOWER LIMB LYMPHOVENOUS FAILURE

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Venous lower limb failure results in trophic changes of skin and paravasal tissues secondary to metabolic disorders. 37 elderly subjects have been monitored within 5-year period. To influence transcapillary metabolism and secure phlebotropic therapy, medical ozone was applied.

Ozonized saline 200.0 mL with concentration of 0.8-1.0 mg/L was infused onto venous bed, 10-12 infusions in total. Regional ozone therapy was additionally performed based on the principles of regional anesthesia by G. Brown, V.F. Yasenetskiy-Voyno and procaine blocks developed by A.V. Vishnevskiy. During the surgical debridement the sites of varicose lymphatic edema, indurations, eczemas and ulcers were needled layerwise to ensure the block by impregnating with ozone and oxygen gas mixture of 20.0-50.0 mL with ozone concentration of 3-5 mg/L. The skin, supra- and subfascial tissues were saturated with ozone from several points along the level of the injured sites, while ozone filled fascial and dermal compartments and paravasal spaces. Trophic wound surfaces were sanitized with olive oil ozonide Otri with Voscopran dressings. The extremities were dressed by compression prolonging ozone exposure.

Alleviation of pain, edema, tissue induration ensured positive changes. Sanitation of wound sites was verified by reduced microbial contamination to $10^2 - 10^3$ per 1 g of tissue and alkalization of medium pH. Series of cytological smears predominantly demonstrated proliferation processes. Adjustment of endogenous metabolic disorders in tissue pathological substrate stimulated regenerative processes evidencing ozone block of chronic lymphovenous tissue endotoxiosis.

Colour duplex ultrasonography of venous blood flow was used to evaluate adjustment of phlebohodynamics reflecting failure of valves and varicose transformation. Echographic signs of reflux blood flow, recanalization and clot formation were not revealed by Doppler scanning in the early period (1-3 months) or at later terms. Coagulograms with prothrombin index (75-92%) and INR (1.0-1.1) demonstrated hemostasis at hypocoagulation level. Anticoagulant effect of ozone was observed against the underlying therapy. Doubtlessly, prolongation of phlebotropic therapy was achieved by the ozone effect on the main components of pathogenesis in macro- and microcirculatory venous bloodstream. Long-term remission periods without phlebitic complications improved quality of life of the subjects and were verified by CIVIQ questionnaire score.

The practical experience allows to recommend the general and regional ozone therapy as an adjuvant approach to the complex therapy of phlebological pathology.

Key words: phlebotropic therapy, transcapillary metabolism, ozone

OZONE-PROCAINE BLOCK FOR WOUNDED AND INJURED PATIENTS AT THE STAGE OF MEDICAL EVACUATION

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Regional anesthesia of major nerve stems has been developed in the years of zemsky medicine and World War I by V.F. Yasenetskiy-Voyno. His "Regional Anesthesia" published a century ago in Petrograd (1915) is topographically comparable to ice anatomy by N.I. Pirogov (1851-1859) reflecting continuity of local anesthesia in the modern practice.

Therapeutic and evacuation approach in emergency medicine is based on the principles of battle-field surgery. The structure of sanitary losses in terms of combined wounds in peacetime and wars in Afghanistan, Chechen Republic, Dagestan Republic is dominated by extremity injuries with purulent and septic complications (33.5-40.5%).

Historical and clinical role is given to "arterial stupor", i.e. the sign of traumatic numbness described by Pirogov at blunt trauma and contusion of vascular stems of extremity in wounded people in Sevastopol (1854-1855). The training on innervations of vessels and prevention of their spasm serve as the basis of nerve block and circular procaine blocks using A.V. Vishnevskiy's method.

We took regional anesthesia as the basis for regional ozone therapy with experience in treating wound and injured patients. Using the effect of medical ozone on the system of tissue antioxidant protection, ozone blocks are reasonable for the injured and wounded subjects with extremity injuries. To prevent pathological pulsation and toxemia at evacuation, procaine block of extremity cross section should be performed with perivulnar administration of antibacterial drug. Similarly, we suggest impregnating the injured tissues with ozone and oxygen mixture at 200-300 mL with ozone concentration of 1.0-3.0 mg/L. The effect of ozonized solution is implemented by its pathway along fascial and muscular compartments, paraneural and paravasal spaces. Ozone injections through aponeurosis and muscles right to the bone fill the anterior and posterior fascial compartment of the injured extremity. Interstitial pathway ensures the solution exposure with extended release of ozone in damaged segments. Wound tissues should be needled perivulnarly and saturated with ozone from several points using squirt-and-cut technique.

Circular ozone block serving as adjunctive therapy to the primary surgical treatment allows to prevent traumatic ischemia and toxemia. At the initial stages of therapy (within the "golden hour") and at subsequent ones, adjuvant ozone therapy along with surgical treatment and administration of antibacterial drugs shall be one of polyvalent components of anti-shock and antiseptic therapy.

Key words: regional anesthesia, ozone and procaine blocks, evacuation stages

Comparative evaluation isolated and combined action of Doxorubicin, Ozone and Oxygen on the Viability of Normal and Malignant Liver Cells in culture

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An experimental work was done to study the influence of doxorubicin and oxidants (oxygen and ozone) on viability of cultural normal Chang liver (Ch.l.) cells and malignant SK –HEP-1 cells. It found similar increase in free radical oxidation in normal and malignant cells of the liver as in the action of ozone and doxorubicin. Doxorubicin was shown to have the highest cytotoxicity, both for normal and malignant cells. Ozone was found to produce marked cytotoxicity when used isolated and in combination with doxorubicin. Oxygen, on the contrary, improved the viability index of the analyzed cells, though in combination with doxorubicin it inhibited enzymatic activity. The received results make it possible to adjust the ozone dose and the route of its administration in various tumor localizations.

Key words: cell culture, doxorubicin, ozone, viability

The Study and Development of nitroxide-generating powder for Burns Treatment

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Introduction

At present, the nitric oxide (NO) is considered to be one of the most important process control agents *in vivo*. It has been estimated that some antibacterial nitromedicines are able to release NO *in vivo* and *in vitro* under oxidation, reduction or hydrolytic decomposition. Cytochrome *c* is used as the antioxidant and the antihypoxant that is caused by its unique enzymatic functions. Taking the above mentioned into consideration, the increase in pharmacological action of cytochrome *c* is expected since its biological activity ensures ability of metalloprotein iron-porphyrin heme to form complexes with nitric oxide.

The general goal in this paper was to create new topical reparant dosage form for burn wound treatment on the base antibacterial nitromedicines able to generate NO or nitrosyl complexes in the presence cytochrome *c*.

Materials and methods

Cytochrome *c* (from heart bovine) ($\geq 95\%$, lot STBB7839V, «Fluka» (USA) «Sigma-Aldrich»), 5-nitrofurural ($>99,8\%$). Composition of powder, (w, %): cytochrome *c* - 0,05; sodium ascorbate - 0,1; 5-nitrofurural - 5%; methylparaben - 0,15; starch up to 100.

Absorption spectra of aqueous solutions (nitromedicine, cytochrome *c*, organic acids, phosphoric acid and their mixtures) were recorded by «Bio line Specord S-100 » (Analytik Jena).

Results and discussion

The interaction of antibacterial nitromedicines with cytochrome *c* in the presence of excesses of ascorbic acid or of sodium ascorbate in the solution has been studied by UV-Vis method. The complexation of $\text{cyt } c^{2+}$ with nitromedicine and later on with NO in reaction mixture during initial ten minutes was suggested by determination of total $[\text{NO}_x]$ – concentration which equaled $15 \pm 5,4 \mu\text{M}$ at $C_{5\text{-nitrofurural}} = 30 \mu\text{M}$ and $22 \pm 5,8 \mu\text{M}$ at $C_{5\text{-nitrofurural}} = 60 \mu\text{M}$, consequently. The formation of cytochrome *c* complexes with nitromedicines similar nitrosyl complexes of cytochrome *c* with nitric oxide was shown.

The pharmaceutical composition on the base nitromedicine and cytochrome *c* has been formulated and developed for treatment of burn wounds. In the experiments by using rats the vasodilatation and regenerating effects were shown when treated wounds by dosage form on the base complexes cytochrome *c* and nitromedicine, able to generate of nitric oxide.

Conclusion

We suppose that pharmaceutical composition containing cytochrome *c*, sodium ascorbate and nitromedicine may be used as dosage forms for treatment of burns.

Key words: nitroxide-generating powder, burn treatment

FEATURES OF OZONE THERAPY IN THE CORRECTION OF FACIAL SKIN AGE CHANGES

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Wither Skin - an inevitable natural process associated with the general process of aging and exposure to aggressive environmental factors. The basis of application of ozone therapy for correction of involuntal changes in aging skin is a well-known biological effects of ozone therapy is to normalize the balance of pro- and antioxidant activity, as well as to increase the oxygen plasma capacity and reducing the severity of tissue hypoxia, improvement of microcirculation and blood rheology.

The study involved 80 women of different ages (from 25 to 63 years). Women in the study group observation (n = 55) conducted a course of ozone therapy injection face and neck. The results were compared with the control group (n = 25), women of the same age which ozone was not performed. Patients in the study group observation 1 time per week (total number 5) was carried out subcutaneous injection of oxygen-ozone mixture with ozone concentration 1-2 mg / L in place of the most pronounced changes involution of the skin of the face and neck. The total volume administered oxygen-ozone mixture averaged 60-100 ml per procedure.

As a result of the rate of injection of ozone therapy according Us- and vizioskanirovaniya and elastometry marked improvement in the structure of the epidermis and the dermal architectonic perfection. Also, fixed restoration of structural and functional organization of the hydro-lipid protective layer of skin, performing a barrier function, reducing moisture loss and increase skin hydration, which is confirmed by the methods and corneometer tevametrii

Key words: cosmetology, ozone therapy

MATHEMATICAL MODELING IN DETERMINING OF THE EFFECTIVE OZONE DOSE IN THE TREATMENT OF LIVER TOXICITY

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The aim of this work was to assess the impact of ozone on changing of the parameters of the dynamics of individual indicators and to determine the most effective dose of ozone in therapy using a mathematical model.

Materials and methods. Experimental studies were conducted on Wistar rats weighing 180 – 200g. the Model of toxic hepatitis was created by the introduction carbon tetrachloride (CCl₄) to all animals. The severity of liver damage was modeled by number of injections of CCl₄. The study was performed at altitude of pathology – in a day and after 10 days. Animals were injected ozonized physiological solution at doses of O₃: 1, 10 and 100 mcg/kg of body weight for 10 days. Animals of control group for 10 days was administered non-ozonized physiological solution. Material for biochemical studies were the blood and liver tissue. We investigated the number of hepatocytes, the relative density of connective tissue, number of mitoses, plasma cholesterol, malonic dialdehyde depending on the degree of intoxication and the dose of ozone.

Results. The basis of the mathematical model proposed by us is a continuous approximation of experimental data of dependences of type « $f = f(CCl_4)$ » characterizing the effect of carbon tetrachloride on the studied parameters $\{f\}$. The dynamics parameters were determined using derivative of first $f' = f(x) = df_{sp}/d(CCl_4)$ and second $f'' = \varphi(x) = d^2f_{sp}/d(CCl_4)^2$ order. It should be noted that f' reflects the speed of the process, and f'' is the acceleration, it allows to estimate the change of generalized energy of status indicator. For statistical processing and mathematical models were used software packages Microsoft Excel, Statistica 6.0 for Windows and MathCad 14.

Conclusion. Thus, the study of the effect of ozone on morpho-functional indicators, by using mathematical modeling, allows to make the conclusion that ozone doses of 1 and 10 mcg/kg have a stimulating effect on the liver, the dose of 100 mcg/kg has already damaging effect.

Key words: mathematical model, reactivity, ozone therapy, effective dose

THE NITRIC OXIDE AND EMOXIPIN IN THE TREATMENT OF BURN ISCHEMIA OF THE CONJUNCTIVA (EXPERIMENTAL STUDIES)

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The purpose

To carry out comparative research of influence of Nitric oxide in gas flow (NO-GF) and emoxipine, and also their joint action on clinical displays and biochemical processes in a plaintive liquid at treatment of burn's ishemym of conjunctiva.

Methods

At 22 rabbits (44 eyes) simulated an alkaline burn III. The medical air-plasma device "Plason" was used as a source of a NO-containing gas flow (NO-GF). Biochemical research of a tear's liquid was performed.

Results

By comparison of the received results of antioxidizing activity of a plaintive liquid to the data of clinical researches, it is possible to speak about advantages of NO - treatment and combined treatment (NO + emoxipine).

The conclusion

Simultaneous application of Nitric oxide in gas flow (NO-GF) with an exposition 15 seconds and emoxipine promotes faster reduction of an inflammation, reduction of edema, faster conjunctiva restoration in a zone of a burn and regional of limbal vessels, restoration of a transparency of a cornea and smaller vascularization.

Key words: nitric oxide, emoxipin, conjunctiva, burns

The justification of the use of physical and chemical methods in treatment of generalized peritonitis and plastics after postoperative ventral hernias

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In 138 patients for complex treatment of generalized pyoperitonitis (GP) solution of sodium hypochloritis (NaClO) and ozonotherapy (OT) were used. Patients in the control group (79) were treated in traditional way. Surgery included liquidation of the source of peritonitis, intraoperative sanitation of the abdominal cavity, nasogastrintestinal intubation with intestinal probe and rational drainage.

The efficiency of the treatment was evaluated on standard results of laboratory analyses of blood and urine, clinical symptoms, elimination of endotoxemia.

Complex use of NaClO and OT in peritoneal lavage allowed to reduce period of abdominal sanitation in two times, helped in cupping of pyo-inflammatory endotoxemia.

Involving physico-chemical methods in the complex of therapeutical measures allowed to reduce the number of postoperative pyo-inflammatory complications by 26.8% and lethality by 14.2.

In 14 patients with postoperative ventral hernias (PVH) laparostomies synthetic prosthesis was used for plastic of hernial ring. After finishing plastics its operation zone was exposed with low-level laser radiation (LLLR).

Use of LLLR in plastic of hernial ring with synthetic prosthesis allowed to reduce postoperative inflammatory complications significantly and avoid suppuration of postoperative wound.

Key words: sodium hypochloritis, ozonotherapy, hernia, peritonitis

Some metabolic effects of singlet oxygen inhalations at experimental burn trauma

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The **aim of this work** was the analysis of peculiarities of the influence of singlet oxygen inhalation on the state of lipid peroxidation and antioxidant activity the blood and lungs of animal with combined thermal injury.

Materials and methods

The experiment was performed on 30 male rats Wistar (body weight 200-250 g). It was formed 3 groups of animals of equal strength: intact group (n=10), including animals that did not perform any manipulation; and 2 experimental groups (n=10 in each), which had a combined thermoinsulation injury. Animals of the control group carried out local treatment of burn wounds drug "Levomekol". At the second day of the experiment animals of the 3rd group, in addition to drug ointment "Levomekol" received inhalation from apparatus of singlet-oxygen therapy "Airnergy" (Germany) for 10 minutes during 10 days. For conducting inhalation the animals were placed in a desiccator, which was carried out by the flow and exhaust of gas mixtures.

In the lung homogenate and in plasma by the method of Fe²⁺-induced biochemiluminescence on the unit BKHL-06 determined the activity of pro - and antioxidant systems. As the evaluation parameters used the light sum of biochemiluminescence, considered as the criterion of intensity of lipid peroxidation (LPO) and the tangent of the angle of inclination of kinetic curve of chemiluminescence (tg 2α) associated with the total activity of antioxidant systems (AOA).

The level of malondialdehyde (MDA) in plasma and erythrocytes were estimated by the method of V. I. Sidorkin and G. A. Chuloshnikova (1993). The activity of superoxide dismutase (SOD) of erythrocytes was studied according to the method of T. V. Sirota (1999).

The data were processed in the software package Statistica 6.1.

Results

It was found that experimental thermal injury in rats' blood plasma even in the face of local treatment with ointment "Levomekol" is formed by a pronounced oxidative stress. This is manifested in the increase of intensity of processes of lipid peroxidation in biological fluids by 54% compared with the level of healthy animals (p<0.05). Against this background, marked reduction was observed in antioxidant reserves of blood plasma (up to 57% of saline values; p<0.05).

Carrying out a course of inhalations, singlet oxygen initiated on the day following the application of animal injury, helps to limit the activity of processes of lipid peroxidation, leading to the 11th day post-burn period to a moderate increase of the light sum of chemiluminescence (+33% compared with the level defined for healthy animals; p<0.05). While the achieved value of the parameter were significantly below the established for rats who received only local treatment of burn wounds (p<0.05).

activity of superoxide dismutase of erythrocytes and the concentration of malondialdehyde in plasma and erythrocytes were also assessed to other metabolic indicators of the balance of pro - and antioxidant systems of blood. It is revealed that when only local treatment there is a clear inhibition of superoxide dismutase activity (by 38% relative to the control group; p<0.05). In contrast, inhalation of singlet oxygen have a stimulating effect on the catalytic properties of the specified antioxidant enzyme, and their level was higher than the values of healthy rats by 10% (p<0.05).

These trends are fully confirmed by the dynamics of the concentration of a marker metabolite of processes of peroxide oxidation of lipids – malonic dialdehyde. It is established that the observer in the plasma of rats with thermal injury the increase of the level of malondialdehyde adjusted inhalation introduction singlet oxygen (+67% and 34% compared to the physiological values, respectively; p<0.05). Similar shifts in the concentration of metabolite were fixed in erythrocytes.

More clearly the dynamics identified for lung homogenates of control animals and major groups. Detected in rats with thermal injury in case of using only topical treatment (ointment "Leavecell") in the lung tissue takes place a pronounced stimulation of the processes of lipid peroxidation (increase of the light sum of

chemiluminescence by 67% compared to intact animals; $p < 0.05$) in combination with the drop in the level of antioxidant capacity (44%; $p < 0.05$).

Carrying out a course of inhalations, singlet oxygen contributes to relief of these shifts, leading to normalization of the activity of pro - and antioxidant systems in the lung tissue. In this case, the intensity of lipid peroxidation is 107% of the physiological values, showing differences from them only at the trend level ($p < 0.1$). Also we registered the optimization of the antioxidant capacity of the homogenates of the lung tissue of animals, which reaches 98% of the norm. Similar dynamics were registered for the concentration of malondialdehyde in plasma and erythrocytes, as in the case of superoxide dismutase activity of erythrocytes.

Conclusions

1. In plasma and lung tissue of rats with combined thermal injury there is a pronounced signs of oxidative stress.
2. Supplement of local treatment of experimental burn disease by course of singlet oxygen inhalations contributes to relief (especially in the lung tissue) the observed imbalance of pro - and antioxidant systems.

Keywords: singlet oxygen, inhalations, lipid peroxidation, biochemiluminescence, malonic dialdehyde

THE ESTIMATION OF ADAPTIVE POTENTIAL OF RATS BLOOD CRYSTALLOSTASIS AT THE ACTION OF NATURAL DONOR OF NITRIC OXIDE

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The aim of this study was estimation of influence of different doses of dinitrosyl iron complexes (DNIC) on own and initiated crystallization of rats blood serum.

Material and methods

Our experiment was executed on 60 male Wistar rats, divided into 6 equal groups. First group of animals (n=10) was intact (without any manipulations, excluding a single blood sampling). Rats of other groups (n=10 in each group) got an intraperitoneal injections of isotonic sodium chloride solution (1 ml.) during 10 days. For third, fourth, fifth and sixth groups the sodium chloride solution contained the DNIC with glutathione ligands (0,15; 0,3; 0,45 and 0,6 mM, respectively).

The study of crystallogenic properties of blood serum samples was performed with teziocrystalloscopy method. Basic substance for teziographic test was isotonic sodium chloride solution. The estimation of crystallization results was carried out with special system of semiquantitive parameters (Martusevich A.K., Grishina A.A., 2009)

Conclusion

In whole, our results indicated on activating effect of glutathione-containing DNIC on crystallogenic properties of blood serum in healthy rats. This effect was realized in elevation of density of crystalline structures and increasing of dendrite elements number. The maximum intensity of this trend corresponded to the concentrations of 0,3 and 0,45 mM of DNIC.

Keywords: dinitrosyl iron complexes, blood serum, crystallization

EXOGENIC NITRIC OXIDE AS A MODULATOR OF BIOLOGICAL SYSTEMS STATE AND BASIS FOR DEVELOPMENT OF INNOVATIVE MEDICAL TECHNOLOGIES

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The **aim of this work** was integration of experimental and clinical studies of molecular, cellular and organismal effects of nitric oxide, as well as the development of a generalized strategy for its application in therapeutic purposes.

Platform for the implementation was to provide a long-term experience of ozone use in various fields of clinical and experimental medicine, as well as a long-term research on physico-chemistry and physiology of nitric oxide.

Materials and methods. We carried out a comparison of the effects of NO produced using various generating devices and chemical synthesis, on abiotic and biological systems. Gaseous nitric oxide was created using the apparatus "Plason" (NO concentration – 800 ppm) as well as the specialized experimental device that allows to synthesize NO in a wide range of concentrations (20-100 ppm). Deposited forms of nitric monoxide presented dinitrosyl and cytochrome complexes of iron.

As abiogenic systems we used bidistilled water and 0,9% sodium chloride solution. They identified pH, redox potential, level of dissolved molecular oxygen and the concentration of active forms of oxygen. The basic biological model for in vitro studies served as units of stored blood of healthy people, which estimated the state of energy metabolism, enzyme systems of detoxification, the intensity of lipid peroxidation in plasma and erythrocytes, the amount of reserves antioxidating enzyme systems, as acid-base balance and partial pressure of blood gases, crystallogenic activity of plasma etc. At the organismal level, the effects of nitric oxide studied in healthy and having a thermal injury of Wistar rats according to the above criteria.

Results. We have shown that low concentrations of NO (100 ppm in gas phase), as it is deposited forms with the gradual release of the connection (in the first place – dinitrosyl-iron complexes), have a much more "soft" adaptogenic action on oils in vitro and body healthy and injury animals compared to the effects of high concentrations of NO (800 ppm) in the parameters of energy metabolism, enzyme systems to detoxify, the balance of Pro - and antioxidant systems, etc.

Conclusion. Thus, the results of experimental studies clearly indicate that the study of cellular, molecular and organismic effects of nitric oxide on the biological systems allows the development of innovative medical technologies for traumatology, combustiology and regenerative medicine.

Key words: dinitrosyl iron complexes, nitric oxide, biological effects

BIORADICAL HOMEOSTASIS: FROM MECHANISMS UNDERSTANDING TO EFFECTIVE MANAGEMENT

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Currently, ideas about oxidative stress goes far beyond free radical biology, finding application in all fields of medicine. The knowledges about possible dismetabolic disorders, in particular associated with the change in the level toxic to biomolecules nitrogen-containing and chlorine-containing radicals are developing. These conditions received the name nitrosative and halogenizing stress, respectively.

On the other hand, the above effective (causing a disease or pathological condition) shifts in the concentrations of reactive oxygen, nitrogen and halogens are examined in isolation. At the same time, in russian and world literature there is a considerable amount of evidence of the relationship of the metabolism of these molecules. Therefore, it seems appropriate to analyze the processes proceeding with the participation of oxygen, nitrogen and halogen-containing radicals, in the framework of a single piece of metabolism.

On the basis of critical analysis of information, relevant literature and results of own experimental research as the hypothesis put forward the concept of "**biological stress**", understood by us as effective (resulting in a negative change of functional metabolic status of the organism) violation of the physiological level of free-radical processes associated with the formation of active forms of oxygen, nitrogen or halogens and/or reduce the activity of systems, limiting their damaging effect. With this in mind, biological stress combines all well-known syndromes associated with shifts in the level of biological stress – oxidative, nitrosative and halogenizing stress.

Additionally substantiates the feasibility of the proposed integrative concept of the simultaneous presence of more than one component of biological stress in the same patient or animal.

Diagnosis of the presence of biological stress should emerge from the definition of its individual components:

- 1) intensification of lipid peroxidation on the background of oppression of antioxidant reserves (a component of oxidative stress);
- 2) improve markers nitrosative stress (in particular, 3-nitrotyrosine);
- 3) increase activity of myeloperoxidase and other parameters, visualizing halogenide stress.

The presence of at least two of these components indicates the presence of biological stress.

To obtain comprehensive characteristics of the response of the organism to the formation of biological stress are used specific markers and nonspecific functional and metabolic criteria. Given the fact that the concept of the study involves consideration of biological stress as a combination of three main interacting components – oxidative, nitrosative and halogenizing, the study will include identification of their specific markers:

diagnosis of oxidative stress is based on studying the intensity of lipid peroxidation processes in blood plasma in conjunction with the total antioxidant activity of plasma;

- identifying nitrosative stress based on the definition of level 3-nitrotyrosine plasma and halogenizing activity of myeloperoxidase.

The introduction of the concept of biological stress involves the study of the effectiveness of different options specific pathogenetic correction of biological stress (introduction of antioxidants, directed stimulation of antioxidant capacity of active forms of oxygen, the use of the regulatory properties of NO, etc.).

Key words: bioradical stress, mechanisms, components, diagnostics

THE INFLUENCE OF SINGLET OXYGEN INHALATIONS ON MICROCIRCULATION IN HEALTHY RATS

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The **aim of this work** was comparative evaluation of the effect of inhalation of ozone and singlet oxygen on the intensity and regulatory mechanisms of the microcirculation of rats.

Material and methods. We have formed 5 groups of Wistar rats. The first group of rats (n=10) were intact and did not carry out any manipulations. Animals of the second to fifth groups (n=10 in each group) received daily inhalations for 10 days. In the second group the inhalation of singlet-oxygen gas mixture was carried out, using 100% capacity of the generator "Airnergy Professional plus" (Germany), the third one got the dry ozone-oxygen mixture (ozone concentration of 60 µg/l), the fourth group – humidified ozone, in the fifth group – ozone-oxygen mixture passed through the layer of olive oil. The duration of all procedures was 10 minutes.

Microcirculation was assessed using laser Doppler fluometry apparatus "LAKK-M" ("Lazma", Russia). The intensity of blood flow in the microvessels was monitored, the microcirculation index, the activity of regulatory mechanisms at the level of the respective components (endothelial, neurogenic, myogenic, cardiac and respiratory ones), and the nature of the inclusion of shunt paths on the value of the indicator bypass.

Results. It is established that the optimal reaction of local hemodynamics on the inhalation of the gas stream from the generator was characterized for the singlet oxygen and humidified ozone-oxygen mixture compared to dry ozone and oil ozonide. A special feature of the action of singlet oxygen is the stimulation intensity of the microcirculation by the activation of the "internal" regulatory mechanisms (especially, the endothelial and neurogenic components).

Keywords: singlet oxygen, ozone inhalation, microcirculation

THE USE OF OZONE THERAPY IN DISEASES ASSOCIATED WITH ATHEROSCLEROSIS

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The efficacy and mechanisms of action of ozone therapy in ischemic heart disease, hypertension and diabetes were studied. It was examined 154 patients with ischemic heart disease, 102 patients with diabetes, 84 patients with hypertension who had the intravenous injection of ozonated saline, major or minor autohemotherapy, rectal ozone-oxygen mixtures insufflate. We studied the data of clinical symptoms, common indicators of lipid metabolism, hemostasis, the concentration of metabolites of nitric oxide (nitrates, nitrites) of blood. On the state of endogenous intoxication was judged by the changes of average weight molecules in blood. Thus, the studies have been shown that ozone therapy in diseases associated with atherosclerosis, has diverse actions and a positive clinical effect.

Key words: ozone therapy, lipid metabolism, haemostasis, nitrates, nitrites, atherosclerosis

Biomimetic interaction of bis-nitroxide methanofullerene and cytochrome c

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Introduction

Nitroxide radicals refer to a unique group of synthetic compounds being antioxidants. Stable cyclic nitroxides such as TEMPO (2,2,6,6 – tetramethylpiperidine-1-oxyl radical) having an effective antioxidant properties and they can be used as superoxide dismutase mimics. Initially, TEMPO is disproportionated into TEMPOH and the N-oxo-ammonium ion, then, ion can act as a well-known oxidant.

The component for biomimetic model of reduction-oxidation of NO species activity was chosen the bis-nitroxide malonate methanofullerene molecule C₆₀, containing two NO - radical groups with the properties of the bis- and multi-site radical traps *in vivo*. Moreover, the C60 fragment can be considered as the electron with drawing polyolefin capable of having oxidizing properties. The antioxidant ability of (NO)₂-MF was estimated using Fe³⁺/Fe²⁺ changes of cytochrome c (cyt c) heme by UV-vis and EPR-spectra.

Materials and methods

Cyt c (from horse heart) (≥95%, lot STBB7839V, «Fluka» (USA) «Sigma-Aldrich»), bis-nitroxide malonate methanofullerene (NO)₂-MF was synthesized Kazan Scientific Centre Russian Academy of Sciences.

Silica gel with sorbed nitroxide species ((NO)₂-MF or TEMPO) were prepared using SiO₂ sorbent (60, 15–49, 40–63 and 63–200 μ, Merck) treated with chloroform solution of nitroxide compounds with following drying at room temperature under vacuum 100 mm within 1 hour. *Absorption spectra* of the aqueous solutions were recorded by «Bio line Specord S-100» (Analytik Jena), 10 mm quartz cuvette, the relative standard deviation (RSD%) being 0.9%. EPR spectra were obtained using Bruker EMX spectrometer at room temperature. (NO)₂-MF thin film on SiO₂ solid support was placed with a special syringe (2 mL) at room temperature.

Results and discussion

It has been shown, that iron (III) in cyt c³⁺ under action (NO)₂-MF was reduced up to iron(II), similar effect was observed under the influence of gaseous NO in aqueous solution, but reduction of iron(III) in heme cyt c was reversible in the presence of TEMPO. Taking in attention, that the formal redox potential for the ferri/ferrocycytochrome c couple in buffer solution at pH 7 is 0.27 V versus NHE, may be proposed the value of redox potential for (NO)₂-MF more than for cyt c.

The changes with time in ESR spectra of (NO)₂-MF monolayers transferred on quartz and then treated by cyt c solution confirm N-oxo-ammonium ion (NO)₂-MF formation.

Conclusion

Therefore, the state of Fe-heme in cyt c can be used as the indicator of the interaction of cyt c with nitroxide species *in vitro*.

Key words: methanofullerene, cytochrome c, nitroxide species

EVALUATION OF THE EFFECTIVENESS OF THE USE OF LOCAL OZONE THERAPY IN THE TREATMENT OF MULTIPLE BLIND SHRAPNEL WOUNDS OF THE LOW LIMBS

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The aim of this work was to evaluate the effectiveness of local ozone therapy in the treatment of multiple shrapnel wounds of the blind of low limbs. Patients were militaries of the Donetsk people's Republic, have received combat trauma in the period from February to may 2015. For the study were selected persons to whom medical assistance was provided in the First military hospital DPR, aged 22 - 45 years with a diagnosis: multiple blind fragmental wounds of limbs. In total we analyzed the treatment of 17 people, arrived in the first days of receipt of a combat injury (4 hours from injury).

Patients received basic detoxifying, antibacterial, corrective therapy. Anti-shock event had carried out according to testimony. Antiseptic solution, metronidazole, 10% "Levomekol" were applied locally. In the process of surgical treatment the primary foci of necrosis and, possibly, foreign bodies were removed (under the control of the C-arc).

Flow gassing was carried out in the chamber by using the apparatus "Medozons BM» once daily on wet surface. The procedure was performed 30 minutes with a concentration of 5 mg/l and a rate of 0.5 liter per minute during the first 7 days. In later (mostly, after the appearance of granulation) ozone concentration decreased to 3-2-1 mg/L. Course was for three weeks, even after the imposition of early secondary, late secondary sutures or autodermoplasty.

Conclusion

1. Local ozone therapy (treatment of wounds in the chambers of the flowing aeration) significantly improves the course of the wound healing process and reduces the time of treatment of patients with multiple blind shrapnel wounds of the limbs.
2. Clinically consistent daily flow gassing of the limb for 30 minutes ozone-oxygen mixture with ozone concentration of 5 mg/l during the first seven days and 3-2-1 mg/l after the appearance of granulation tissue until wound healing was effective.

Key words: local ozone therapy, non perforating shrapnel wounds, the lower extremities

THE INFLUENCE OF OZONE THERAPY ON THE CONCENTRATION OF NITRIC OXIDE IN HYPERTENSION

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The work is dedicated to the study a concentration of nitric oxide (nitrate and nitrite) during the arterial hypertension under the influence of ozone therapy. The object of the study was the blood samples of 80 persons with hypertension before and after treatment. The subject of the research was indicators of the exchange of nitric oxide - nitric oxide metabolites (nitrates/nitrites) in plasma in patients with arterial hypertension. The level of nitrates and nitrites was evaluated in a protein-free extract by spectrophotometry on a spectrophotometer Apel PD 303 (Japan). The course of treatment was 10 procedures for the introduction of ozonated physiological solution through the day. Ozone was generated using a ozone generator "Kvazar" when a current of the barrier discharge using medical oxygen. The ozonation of the solution was carried out by a 10-minute sparging with 200 ml of 0.9% NaCl solution, ozone-oxygen gas mixture with ozone concentration at the outlet of the ozonator from 1500 mcg/l of gas. The increase in the concentration of NO metabolites in blood of patients with arterial hypertension was marked compared to the control group at 40%, which indicated the presence and progression of pathological vascular mechanisms in the body. Conducted ozone therapy of patients with arterial hypertension led to a decrease in the concentration of nitrate and nitrite in 28% on average. Thus, the inclusion of ozone therapy in the treatment and prevention of hypertension allows to get a significant and lasting clinical effect.

Key words: ozone therapy, hypertension, nitrates, nitrites

Microcirculation state at prolonged use of ozonated saline in a chronic experiment

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The **aim of this study** was estimation of influence of ozonized saline infusions on rats' microcirculation state.

Material and methods

The experiment was performed on 40 Wistar rats, divided into 4 equal groups. Duration of experiment was 60 days, during the first 30 days the animals of the first experimental group daily intraperitoneally injected with 1 ml of 0.9% sodium chloride saturated with an ozone concentration of 3000 µg/l .(ozone dose of 0.6 µg) For animals of the second experimental group the saturated ozone concentration was 10,000 µg/l (the ozone dose - 2 mg), for the third experimental group – 40000 µg/l (the ozone dose of 8 mg). Animals in the control group received oxygenated physiological solution.

We evaluated the state of the microvasculature at the end of the experiment and 30 days after its completion with laser Doppler flowmetry using the LAKK-M ("LAZMA", Moscow). the intensity of microcirculation (microcirculation index - PM), the activity of its regulatory components and the degree of involvement of shunt paths were studied.

Results

It has been shown that long-term use of ozone for 30 days, has a dose-dependent effect on the microcirculation, while the effect of low concentration of the compound (0.6 mg) stimulating microcirculation surround keeps this effect even for 30 days after discontinuation of exposure. Large doses of ozone (2.0 and 8.0 mg), stimulating microcirculation system during long-term exposure, after its cancellation lose their modulatory effect on the microcirculation, compensating for it remains low shunt mechanisms.

Key words: ozone, microcirculation

THE INFLUENCE OF OZONE THERAPY ON THE AUTONOMIC NERVOUS SYSTEM IN PATIENTS WITH ATRIOVENTRICULAR BLOCK SECOND DEGREE

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Introduction: One of the topical problems of professional competence is the identification of episodes of atrioventricular blocks (AV blocks) second degree recorded without signs of organic heart disease in young train drivers.

Objective: to assess the degree of severity of disorders of the autonomic nervous system (ANS) in patients with AV-blockade of 2 degrees with the conduct cardiovascular tests (KW) by Ewing before and after treatment with ozone therapy.

Materials and methods: the study included 35 patients aged from 25 to 42 years identified during Holter monitoring of the electrocardiogram, a single night episodes of AV block 2nd degree type 1 Mobitz who were treated in the cardiology Department. On the background of standard therapy they received 7 sessions of ozone therapy at 1200 mg/l in 200 ml of physiological solution. In the selection of patients was taken into account absence of other co-morbid arrhythmias. KW on the Ewing was performed using the "Poly-Spectrum 8EX" firm "Neurosoft". When carrying out the ITC evaluated the following factors: the rate of breathing, 30:15, Valsalva, decreased systolic blood pressure in the orthostatic test, the increase of diastolic pressure when conducting the test with the isometric contraction. According to the test results summarized points (0-1 point - there are no violations (initial violation), 2-3 points – moderate violations, 4 or more is expressed by the human), on the basis of which it assessed the degree of impairment of sympathetic and parasympathetic autonomic nervous system (SNA, PSPA, respectively).

Results: According to the degree of severity of disorders of the autonomic nervous system before treatment in 20 patients (57,2%) prevailed expressed by the human SNS and PSNS moderate disorders, in 8 patients (22.8%) of moderate violations of the SNA and the initial PSNS, and moderate violations SNA in 7 patients (20%). After treatment, the severity of violations decreased significantly. Moderately expressed violations of the SNA and the initial violations of PSNS detected in 6 patients (17,2%), primary violations of the SNA and PSNS were observed in 9 patients (25.7 per cent), primary violations SNA in 16 patients (45.7 per cent), primary violations PSNS in 3 patients (8,6%), 1 patient (2,8%) after treatment there was no violations in the functioning of the ANS. The number of total points in the group before treatment was 7 in group after treatment of 4 points ($p<0.001$).

Conclusions: In the group of patients before treatment ozone therapy prevailed expressed by the human SNC and moderate disturbances in the functioning of the PSNS, indicating the secondary parasympathicotonia in patients with AV block 2nd degree type 1 Mobitz. In the group after treatment with ozone therapy the intensity of disorders in the functioning of the PSNS and SNS decreased, which shows a positive influence on the functioning of the VNS treatment of ozone and the improvement in the balance between SNS and PSNS, which has a positive effect on atrioventricular conduction.

Key words: ozone therapy, sympathetic and parasympathetic nervous system, atrioventricular block

INVESTIGATION OF BIOANTIOXIDANT ACTIVITY OF PYRIMIDINE AND THIETHANURACIL DERIVATIVES IN VIVO

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Extensive study of pyrimidine and uracilthiethanes derivatives (PD) showed mixed action of this group of substances on animals and humans. At present the antioxidant activity of the PD is given to serious consideration as a possible mechanism through which implemented the biological effects of this group of compounds as substances that normalize the oxidative processes in the body. The high antioxidant activity of new PD in model systems, which causes the formation of oxygen radicals and the reaction of free radical oxidation (FRO).

The purpose of the study - to investigate the effect of the new PD and the impact of physical activity (swimming test) on the processes of FRO in the experimental animals. Objectives: 1) To investigate the effect of selected PD on behavioral responses, indicators of functional metabolic activity of phagocytes blood FRO processes in the brain, liver and blood plasma of experimental animals in health and physical activity (FA). 2) Assess the possibility of using PD for the prevention and correction of the negative effects of oxidative stress.

Materials and methods: Animals (80 white rats weighing 200-220g) for 24 days with PD intragastrically at a dose of 50 mg/kg as a suspension in a 2% starch mucus. The first group - control (intact), the second - on a daily basis received the drug under the code I, third - IX, fourth - X, fifth subjected daily FA, the sixth - a drug I and FA, the seventh - the preparation IX, and FA, the eighth - the drug X and FA .

To evaluate the measurement of reactive oxygen species in the blood was studied spontaneous and induced by zymosan luminol-depended chemiluminescence (ChL). Lipid peroxidation in liver homogenates and rat brain, the blood plasma were evaluated by recording Fe-induced ChL and the content of malondialdehyde (MDA). Total antioxidant activity was determined by spectrophotometry TAS. Separately studied the behavioral responses of experimental animals (the open field test, swimming test); morphological composition of blood, phagocytic activity and functional reserve of phagocytes. We used the software package Statistica v.10 (StatSoft), Student's t test and the nonparametric Mann-Whitney test. The obtained results were considered significant at $p < 0.05$.

Results: The swimming load in rats caused psycho-emotional stress, increased of adrenal glands weight, the total number of white blood cells. Among behavioral reduced mobility ratio and the estimated activity, increased emotional anxiety. Among other parameters of animal blood decreased phagocytic reserve. ChL intensity homogenates of brain, liver, MDA content increased. Introduction of new PD amid exercise prevented disruption of FRO in the brain and liver, resulting in values behavioral and morphological parameters of blood and its functional reserve closer to normal.

Conclusions: FA caused acceleration of FRO in homogenates of brain, liver, rat plasma. The introduction of selected PD experimental animals on the background of FN reduced the negative impact of stress. FA depressed oxygen-dependent metabolism in phagocytes and the generation of reactive oxygen species. The introduction of selected PD ensures the preservation of the oxidizing activity of phagocytes at the control level. Identified antioxidant properties of the investigated allow us to recommend the PD they can be used to correct the negative effects of oxidative stress and recovery of free radical balance.

Key words: antioxidants, pyrimidine and thiethanuracil derivatives, reactive oxygen species, free radical oxidation

BIOENERGETICS CORRECTION AS A COMPONENT OF THE EFFECT OF REACTIVE OXYGEN SPECIES AT SYSTEMIC OZONE THERAPY OF BURN DISEASE

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Under the experimental conditions (in vitro and in vivo) to a combined thermal injury model disorders of energy producing systems, developing as a result of hypoxia, were established. The system ozone application contributed to the intensification of the ATP production at the tissue level by activation of the oxygen blood oxidoreductases and enzymes of mitochondrial level. In the clinical conditions in patients with thermal trauma the use of active oxygen form – ozone (big autohemotherapy with ozone and intravenous infusions of ozonized saline solution) in the complex therapy was accompanied by restoration of oxygen transport blood function, improvement of microcirculation, stimulation of the respiratory function and the central hemodynamics, activation of oxidoreductases and volatile plastic processes.

Key words: hypoxia, thermal injury, the energy deficit, microcirculation, ozone therapy

The study of quality of life as a factor in the evaluation of the efficacy of ozone therapy in the rehabilitative treatment at a late stage of rehabilitation of patients with gonarthrosis who have undergone total joint replacement

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In the work we studied the influence of ozone therapy on the parameters of quality of life in patients with osteoarthritis of the knee who underwent total endoprosthesis of joint. The study included 42 patients with a diagnosis of bilateral gonarthrosis, status after endoprosthesis of knee. In parallel with the standard set of measures patients completed a course of ozone therapy (subcutaneous and intradermal injection of ozone-oxygen mixture in the amount of 60 ml with ozone concentration of 5 mcg/ml) on not the operated joint (20 ml) and in the projection of the lumbosacral (40 ml). Each patient received 5 treatments. Ozone therapy was carried out using the UOTA-60-01 "Medozon". Quality of life was studied using questionnaire SF – 36 (Item Short-form Survey Health Survey). To assess the effectiveness of treatment of patients we used the WOMAC index. The use of ozone therapy in complex rehabilitation treatment, promotes essential increase of efficiency of rehabilitation of patients after total knee replacement, has a positive effect on the functional activity of the joints, increases the level of physical and mental health, improves the quality of life of patients.

Key words: ozone therapy, gonarthrosis, endoprosthesis

AN ANALYSIS OF THE ARCHITECTONICS OF BONE TISSUE AS THE OBJECT OF OZONE STERILIZATION

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The new information about the architectonics of bone and its main components have been obtained by using of a complex morphological techniques (light microscopy, scanning electron microscopy, acoustic microscopy), compositional analysis. Emerging at various stages of bone formation system of canals, lacunae and tubular, and intrastructural spaces represent volume oriented system communicating intraosseous spaces (SIS)., the presence of which provides favorable conditions for the effective use of ozone sterilization in the manufacture of bone implants. Quantitative relationships have been established to define the basic characteristics of the SIS.

Key words ozone sterilization, bone implants, system of intraosseous spaces

Ozone and Ozonated Growth Factors in the Treatment of Disc Herniation and Discartrosis of Lumbar Spine

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The management of the disc herniation and its complications through highly invasive surgical techniques has drawbacks including the high number of adverse effects. Intradiscal injection with ozone has shown high therapeutic efficacy and the use of growth factors derived from platelets is increasingly used in tissue regeneration. The present study aimed to demonstrate the efficacy and safety of ozone on the herniated disc and the healing and restorative effect of growth factors on degenerative disc syndrome. A prospective, single-center, nonrandomized study was carried out involving 60 patients in an age range of 35-82 years old diagnosed with severe lumbo-sciatica, Visual Analog Scale (VAS) 7-8. The patients were infiltrated 5-8 mL of ozone at 25-35µg/mL intradiscal, 1mL of concentrated growth factor (CGF) and 0.5 mL of CD34+ cells. Foraminal and facet injection was done with 10 cc of ozone at 10 µg/mL, 2 cc CGF and sacro-hiatal injection with 15 mL of ozone at 15µg/mL plus 1 mL of CGF. Evaluation of the patients was followed by monitoring clinical symptoms, EVA (visual analogue scale) assessment, and MRI (Magnetic Resonance Imaging) methods. The results showed significant improvement ($p<0,01$) 90% of complete resolution with EVA 0-2 at 4 and 6 months, and MRI showed resolution of the hernia and rehydration of damaged discs. The remaining 10% showed a partial resolution. The 5% percent of these patients reported adverse reactions (2 patients with mild transient headache and one with pneumocephalus resolved at 48 h). These results demonstrated the efficacy and safety of the procedure in this type of pathology.

Key words: CGF, PRP, Ozone, Intradiscal injection, CD43+, growth factors, disc-hernia, disc degenerative syndrome

OZONE CONDITIONING EFFECT, MOLECULAR MECHANISM AND ROLE OF NUCLEAR FACTORS

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The Nuclear factor, Nrf2 is a master transcription factor that regulates EpRE or antioxidant response element (ARE) or human antioxidant response element (hARE) in human, mediated expression genes encoding antioxidant enzymes and cytoprotective proteins to cellular stresses. These Nrf2-regulated genes can be classified into phase II xenobiotic-metabolizing enzymes antioxidants, molecular chaperones, DNA repair enzymes, and anti-inflammatory response proteins, thereby reducing reactive compounds such as electrophiles and free radicals to less toxic intermediates whilst increasing the ability of the cell to repair any damage ensued. Importantly, Nrf2 has been shown to possess an EpRE sequence within its own promoter region providing a platform for Nrf2 to initiate its own transcription further enhancing the adaptive cell defense response.

Recent studies suggest that the sequence context of the EpRE (electrophile-responsive element) the nature of the chemical inducers, and the cell type are important for determining the activity of the enhancer in a particular gene. The evidence of the EpRE pathway was observed also for some xenobiotics modulating the regulation of Phase I and Phase II drug-metabolizing enzymes. Nrf2 is a powerful protein located within each cell in the body and it is activated by an Nrf2 activator. Once released it migrates into the cell nucleus and bonds to the DNA at the location of the EpRE which is the master regulator of the entire antioxidant system located in all human cells. We know that excessive free radicals induce better antioxidant production through this pathway, but the question is: ozone also does? It seems that ex vivo it does. However what does occur in vivo in the patient's blood? It is ozone able to induce and trigger throughout Nrf2 the production of thousands of antioxidant molecules, providing far better protection against the brain and total body damaging effects from free radicals?

Key words: ozone, ozone therapy, Nrf2, nuclear factor erythroid 2, Autohemotherapy, EpRE, electrophile-responsive element

Investigation of the effectiveness of ozone therapy in the treatment of venous ulcers

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In the development of venous ulcers main role belongs to the microcirculation change. This article describes a method for radionuclide studies of tissue blood flow and long-term-non-healing venous ulcers. Combined application of ozone-oxygen mixture in a plastic chamber and jetting washing application on ulcers ozonized solutions (physiological saline solution) lead to a normalization of the peripheral blood, in contrast to the control group. Thus, the ozone in the complex therapy promotes early normalization of microcirculatory disorders and is pathogenically substantiated.

Key words: microcirculation, ozone, venous ulcers

OPERATION OF LPO-AOD AND LEVEL NO METABOLITES DURING FORMATION OF BRONHOPULMANORY DISEASES IN ECOLOGICALLY ADVERSE VLADIVOSTOK AREA

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The damaging action of air pollutants on the respiratory tract is connected with impaired functioning of the system of lipid peroxidation-antioxidant protection (LPO-AOD). The purpose of our work was to study features of system operation a LPO-AOD and NO at formation of diseases of bronchopulmonary system in the conditions of ecologically adverse Vladivostok area. Patients' research was conducted according to Helsinki declaration (2008). 206 persons are surveyed. From them 19 patients with chronic obstructive pulmonary disease (COPD), a stable flow (10 people mild and 9 persons of moderate severity), 79 - controlled bronchial asthma (BA) and 53 persons with chronic non-obstructive bronchitis catarrhal (CHNBC) in remission. The control group included 55 apparently healthy. Diagnosis of COPD was performed according to Federal clinical recommendations on diagnostics and treatment of COPD, 2014 and GOLD-2014, AD - according to GINA 2015 and CHNBC - International Classification of Diseases, 10th Revision. From research patients with accompanying pathology in stage of decompensation were excluded. The groups were matched by age and sex. In all patients, the levels of NO metabolites, the content of malondialdehyde (MDA) in the red blood cells, the integral index - the antioxidant activity of blood plasma. The methodical base of research was by studying of interrelations between environmental parameters and system ratings LPO-AOD, NO, spirometry in patients with bronchopulmonary diseases and in those of healthy living in favorable and unfavorable environmental conditions. Power performance evaluated of intrasystem (Ds) and intersystem (Dm) correlation communications designed parametrised and nonparametric modules. Analysis of the results showed that people living in polluted areas, high levels of intrasystem capacity (Ds) in the LPO-AOD and spirometry systems. At patients with bronchopulmonary pathologies power (Ds) of system LPO-AOD was by 10-50 % above as compared with control group. At patients with COPD in a hostile area of the city significant communication is revealed between the ratings of the system of LPO-AOD and NO ($r = 0,22$; $p < 0.05$); in patients with asthma - between NO and spirometric indices ($r = 0,2$; $p < 0.05$). Thus, in the conditions of anthropogenic impact those with bronchopulmonary diseases, experiencing increased tension in the functioning of LPO-AOD system and respiratory function. These data will allow to develop preventive events, to change approach to the treatment of diseases of bronchopulmonary pathology in view of violations of individual links of free radical metabolism.

Key words: nitric oxide (NO), LPO-AOD system, respiratory system diseases, adverse environmental conditions

Pretransfusion conditioning possibility of canned erythrocyte by ozone

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BACKGROUND

To develop a methodology and to explore the clinical efficacy of ozonated 0.9% solution of NaCl (ODF) for rehabilitation pretransfusion canned red blood cells in patients with peptic ulcer hemorrhage etiology.

STUDY DESIGN AND METHODS

The object of research was stabilized CFDA 1 in a ratio of 1: 4 red cells of human blood. Red blood cells stored at 4 - 30 days. During Ozonation red cells (2 ml) and different storage periods ozonized mixed with 0.9% sodium chloride solution in an equivalent volume containing various concentrations of ozone. After 1 hour exposure obtained erythrocyte suspension was determined concentration of ATP and 2,3 diphosphoglycerate. This technique pretransfusion rehabilitation canned red blood cells was performed in the study included 63 patients with gastrointestinal bleeding. The study group (n = 33) consisted of patients who, in addition to the standard intensive therapy was carried out according to generally accepted indications a single transfusion of red cells pre-mixed in a ratio of 1: 1 with ozonated solution 0,9% NaCl with ozone concentration of 2 mg / l. Differences of averages, recognized significant at the level of statistical significance of $p < 0.05$.

RESULTS

The optimum concentration of ozone in solution, with the same ratio of volume of processed erythrocyte and ODF is 2 mg / l. The ratio in the erythrocytes canned registered growth of both forms of inorganic phosphate. Studies have demonstrated the ability to indirectly influence the donor red blood cells treated with the ODF on the metabolism of red blood cells of the recipient, even when their single transfusion. So, within 48 hours after transfusion of red blood cells ozonated, recorded a significant increase in their sodrezhaniya 2,3-difosofoglitserata and adenosine triphosphate, which in turn will naturally affect the severity of correcting red blood cell - associated disorders of the oxygen transport system. The largest group differences in the concentrations of 2,3 DPG were recorded during the first days after the transfusion of red cells treated with ozone, averaging 32.5%. Improving the energy security of the oxygen transport in the study group was persistent and was maintained up to 72 hours after transfusion, exceeding that of the control group average of 19.4%. A significant antioxidant activity of ozonated red blood cells has been identified in the study of the dynamics of indices of lipid peroxidation and antioxidant activity in plasma and red blood cells of patients. However, immediately after the standard transfusion, we have initially high growth I max was observed in the control group with 29.9 ± 0.27 e. to $31,3 \pm 0,36$ e., which demonstrated the detrimental effect of transfusion of red cells, especially long shelf life, on the severity of endotoxemia in patients with hemorrhagic shock. Whereas the use of the ODF erythrocytes from the first day to correct LPO - in particular reduced the initially elevated level of I max with a $30,4 \pm 0,49$ e. to $28,3 \pm 0,19$ e. In the future, these changes became more significant, up to 3 days of therapy, when the between-group difference in this indicator averaged 36.8%. On the other hand, the use of the ODF erythrocytes was accompanied by a more rapid ($P < 0.05$) reduction of the level of antioxidant activity, which was reflected in a significant increase in intergroup and mezhetapnom initially discounted rates starting from 2 days of intensive care. For between-group differences on these measures at 48 and 72 hours after transfusion averaged over S light sum of 41.6% and 28.3%, and Tg a - 15,5% and 18,1% respectively. Application of ODF erythrocytes, compared with the standard blood transfusion, normalization compromised left ventricular systolic function, severe blood loss on the third day of intensive therapy. In particular, initially registered on the background of a slight decrease in blood transfusion in cardiac index in the study group to $2,7 \pm 0,37$ l / min * m² to $2,5 \pm 0,24$ l / min * m² directly on the stable

after a blood transfusion is replaced growth indicator after 48 and 72 hours of therapy of 20.1% and 31.3% respectively. Initially, the oxygen delivery to the representation of the group has been reduced with respect to the proper values, primarily due to hemodynamic and hematic reasons caused by blood loss and was held $253,9 \pm 24,33$ ml / min * m² and $243,6 \pm 23,98$ ml / min * m² in the control and study groups, respectively. In this situation, in the groups noted a compensatory increase in oxygen consumption rates in excess due to an average of 27.1%, with increasing utilization ratio to 37.6%. Significant changes in a set of indicators of blood oxygen-function in the studied patients had a 2 - 3 days of therapy, which is highly correlated with the dynamics of indices of lipid peroxidation - antioxidant activity and the concentration of erythrocyte macroergs. Most of the severity of this reaction in patients treated with IER, primarily due to the optimization of energy processes in transfuziruemyh and in red blood cells of the patient, as well as the correction of lipid peroxidation and antioxidant activity processes, positive impact on the dynamics of such an important indicator of the severity of tissue hypoxia as serum lactate. Significant and sustained reduction in the initially elevated levels of lactate to $4,1 \pm 0,56$ mmol / l in the study group was able to achieve in a day carried out intensive care to an average of $1,3 \pm 0,30$ mmol / l. Whereas, during the period, on top of standard blood transfusion, there was an increase in this indicator in an average of $5,0 \pm 0,47$ mmol / l, and its further decline was considerably slowed and reached normal values is only the third day of intensive care ($1,6 \pm 0,26$ mmol / l). When the IER in intensive care significantly reduces the time patients stay in the ICU from 4.9 to 3.6 days, reduced the incidence of multiple organ dysfunction syndrome (MODS) from 33.9% to 21.1%.

CONCLUSIONS

Comparison of the results of transfusion therapy by the proposed method with the traditional approach has shown that pre-treatment with ozone allows significantly greater degree to reduce manifestations of tissue hypoxia and improve delivery processes, consumption and utilization of oxygen. The use of ozonated red blood cells increases the activity of the antioxidant system, has Antihypoxanth action, helps to reduce the intensity of lipid peroxidation.

Key words: ozone, preserved red blood cells, gastrointestinal bleeding, hypoxia

THE CHANGE OF INDICATORS OF PRO - AND ANTIOXIDANT SYSTEMS OF THE LIVER UNDER THE INFLUENCE OF UBIQUINONE-10 IN EXPERIMENTAL THERMAL INJURY

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For the correction of metabolic disorders in patients with burns the natural antioxidant ubiquinone-10 (Q-10) can be used. Q-10 is used for the treatment and prevention of various pathologies. The aim of this work was to study the influence of Q-10 on pro - and antioxidant system in liver of rats with thermal injury.

Material and methods

The experiment was conducted on Wistar rats. Under anesthesia contact burn (20%) was inflicted and rats were removed from the experiment on the 11-th day. It was formed 3 groups: 1 – intact healthy rats (n=10); 2 – control – animals with burns (n=10); 3 – experience (n=9) – animals with burns, treated with daily Q-10 (15 mg/kg). In the liver homogenate lipid peroxidation (LPO) and total antioxidant activity (TAA) were studied by method of biochemiluminescence, malonic dialdehyde (MDA) and activity of superoxide dismutase (SOD) were determined. Statistical data processing was performed using Statistica 6.0.

The results and discussion

The increase of LPO in the liver was marked in animals with thermal injury on the background of the decrease of antioxidant reserves. This led to the development of oxidative stress. During the burn the concentration of MDA statistically significant increased in 1.8 times in comparison with intact group of animals. The decrease of TAA and SOD activity was revealed in liver of rats with burn on 46.3% and 3.32% in comparison with healthy animals. It was established that the use of Q-10 in complex treatment of experimental thermal injury led to a decrease in the intensity of peroxidation in the liver of rats and increase of antioxidant activity. The reduction of the intensity of LPO and MDA concentration on 48.7% and 4.7% was marked in animals treated with Q-10 in comparison with the control group of rats. Q-10 caused the increase of TAA in the liver of rats on 0.4% and 87% in comparison with healthy animals and rats with burn, respectively, reducing the degree of oxidative stress. The application of ubiquinone in the treatment of the burns contributed to the increase of SOD activity in the liver on 49.4% in comparison with control and on 44.4% in comparison with healthy rats.

Conclusion

The received results allow to conclude that the use of Q-10 in complex treatment of experimental thermal injury leads to a decrease in the intensity of free radical processes in rat liver. The increase of total antioxidant activity was showed under the influence of the Q-10 in comparison with standard treatment.

Key words: ubiquinone-10, liver, pro- and antioxidant systems

THE ASSESSMENT OF PRO - AND ANTIOXIDANT STATUS OF THE STORED BLOOD UNDER THE INFLUENCE OF BERLITION IN THE CONDITIONS OF OXIDATIVE STRESS

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An important link in the pathogenesis of many diseases is the imbalance of oxidative metabolism. Promising antioxidant is a thiol bonding – berlition – α -lipoic acid. The aim of this work was to evaluate the influence of berlition on the dynamics of oxidative metabolism conserved blood under conditions of oxidative stress.

Material and methods

The experiment was conducted on conserved blood. Blood were exposed to ROS (ozone, nitric oxide, singlet oxygen) and berlition. The method of induced biochemiluminescence was used for the estimation of intensity of lipid peroxidation (LPO) and total antioxidant activity. The concentration of malonic dialdehyde (MDA), the activity of superoxide dismutase in the blood were determined by spectrophotometrically. Statistical data processing was performed using Statistica 6.0.

Results and discussion

According of biochemiluminescence analysis it was shown that the use of berlition contributed to the increase of LPO on the backdrop of the impact of all ROS: when using O_3 – on 3% ($p=0,098$), in case NO – on 6% ($p=0,081$), to singlet oxygen – on 12% ($p=0,023$) in comparison with corresponding ROS.

The received result was confirmed by the data of measurement concentration of MDA in blood plasma when the blood bubbling singlet oxygen: the MDA content increased by 72% under the influence of berlition. In conditions of oxidative stress caused by NO berlition led to a decrease in the concentration of MDA in plasma by 31%.

In erythrocytes berlition caused the decrease in the concentration of the secondary product of LPO on 62% after the impact of gaseous ozone.

Berlition caused an increase of total antioxidant activity of plasma against the background of the effect of all the ROS: when using O_3 – on 14% ($p=0,087$), in case NO – on 20% ($p=0,031$), to singlet oxygen – on 23% ($p=0,028$) compared to corresponding ROS. The activity of superoxide dismutase under the influence of berlition also increased when O_3 on 11% ($p=0,042$), in case NO – on 26% ($p=0,017$) compared with the corresponding ROS without the use of an antioxidant.

Conclusion

Thus berlition has antioxidant properties, manifested in increase of total antioxidant activity and activity of superoxide dismutase, reducing oxidative stress.

Key words: blood, berlithione, pro- and antioxidant systems

THE EFFECT OF MEXIDOL ON LIPID PEROXIDATION SYSTEM OF THE CONSERVED BLOOD UNDER THE INFLUENCE OF REACTIVE OXYGEN SPECIES IN THE EXPERIMENT *in vitro*

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The study of the system of lipid peroxidation *in vitro* under oxidative stress in the aspect of the rationale for the use of antioxidants, in particular, mexidol medical therapy of free radical processes with its use are relevant. The aim of this work was to evaluate the effect of mexidol on the dynamics of oxidative metabolism conserved blood when exposed to reactive oxygen species.

Material and methods

The experiment was conducted on conserved blood. Blood were exposed to ROS (ozone, nitric oxide, singlet oxygen) and mexidol. The method of induced biochemiluminescence was used for the estimation of intensity of lipid peroxidation (LPO) and total antioxidant activity. The concentration of malonic dialdehyde (MDA), the activity of superoxide dismutase in the blood were determined by spectrophotometrically. Statistical data processing was performed using Statistica 6.0.

The results and discussion

The results showed that the use of mexidol (2-ethyl-6-methyl-3-oxypyridin succinate) led to lower of LPO in blood plasma after the impact of all ROS: when using a O₃ – 20% (p=0,098), with NO – 46% (p=0,081), singlet oxygen – 36% (p=0,023) compared to corresponding ROS. Under the action of mexidol the concentration of secondary product of lipid peroxidation, MDA, also decreased on the background O₃ in the plasma by 50% (p=0,098) and in erythrocytes by 7% (p=0,081). Despite the decline in total antioxidant activity under the influence of mexidol in the application of the ROS, an increase in the specific activity of superoxide dismutase was marked when operated at NO – 15% (p=0,031), singlet oxygen – 12% (p=0,043) compared to corresponding ROS. It is known that mexidol is an antioxidant, protector of membranes, inhibits the production of free radicals, reduces the activation of lipid peroxidation, increases the activity of enzymes of antioxidant protection of cells.

Conclusion

Thus, mexidol is an effective tool against free radical oxidation, reducing the intensity of lipid peroxidation in experimental oxidative stress. It was found that mexidol has antioxidant properties, manifested in increased activity of superoxide dismutase.

Key words: mexidol, blood, lipid peroxidation, total antioxidant activity

The state of the enzyme link of the antioxidant system for patients with alcohol withdrawal syndrome of on the background of ozone therapy

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Introduction

Ozonotherapy today is a highly efficient and cost-effective method for the treatment of a wide range of diseases with multifaceted pathophysiological effects of targeting universal mechanisms of sanogenesis. The use of medical ozone for the relief of the alcohol withdrawal syndrome (AWS) is relevant due to the frequent side effects from drug therapy.

The aim of our study was to examine the fermentative link of the antioxidant protection (AOP) of the organism on the background of complex treatment with the inclusion of oral introduction of refined ozonated olive oil "Ozonide" into patients with alcohol withdrawal syndrome.

Material and methods

In complex relief pharmacological treatment of AWS in the main group (30 patients) oil "Ozonide" was used, which was prepared on the basis of olive, refined oil, in which with ozone generator was added at a flow rate of 0.5 l/min ozone-oxygen mixture at a concentration of 6 mg/l, the time of sparging for 1 hour. "Ozonide" was applied per os at 5 mg 3 times daily for 7 to 10 days. In the control group (30 patients) on the background of standard treatment, the AWS was brought refined olive oil in the same way.

AWS in the main and control groups before treatment was - $31,53 \pm 1.2$ points and showed no significant differences. In the main group (96,7 \pm 4)% of patients medical relief of withdrawal symptoms was achieved usually in 5 to 10 days. In the control group the reduction of withdrawal symptoms was achieved over a longer period of treatment: 5-10 days (70,2 \pm 5)% of patients, more than 10 days (29,4 \pm 6)% of patients. After the complex treatment with the use of "Ozonide" the severity of the AWS in the main group patients significantly decreased to $5.7 \pm 1,1$ in the control to 7.3 ± 0.4 points ($p < 0.02$). Thus, in the main group on the background of ozonotherapy more pronounced regression of clinical symptoms of AWS was observed in compared with patients not receiving the "Ozonide".

Results and discussion

It has been revealed that all the patients with AWS had the condition of oxidative stress that was manifested by the increased level of carbonyliron protein (CB) and Schiff bases (SO), the decrease in the content of superoxidodismutase (SOD) and increased concentration of glutathioneperoxidase (GPO) which activity was not enough to suppress the processes of free radical oxidation. After the treatment, the level of CB in the main group decreased by 16% and in control group it increased by 57%. The end product FRO – SO and the concentration of SOD has not fundamentally changed in any group after the treatment. In the main group increased activity of GPO was revealed after the treatment by 35% and in the control group it decreased by 16%, which led to reliable differences in the activity of this enzyme in the studied groups of patients ($p < 0.001$).

Conclusions

It can be assumed that the therapeutic effect of ozone and its oral introduction is manifested in the activation of glutathioneperoxidase, one of the most powerful enzymes – glutathione-component of antioxidant defense.

Key words: alcohol withdrawal syndrome, oxidative stress, antioxidant enzymes, ozonotherapy

Evaluation of the effectiveness of ozone therapy in the treatment of back pain

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Applicability

80% of world population is subject to regular back pains. 98% of back pains are of mechanical origin. About 2 million people visit doctors every year due to back problems. People from 30 to 50 years of age suffer from back pains mostly.

The estimation of efficiency of application of ozone therapy for the treatment of back pain was held. The study was conducted on the basis of Institute of Traumatology (Nizhny Novgorod) in 2015. The study included 30 patients with back pain. Evaluation of pain syndrome was performed using a 10-point visual analogue scale. Morphological changes of the lumbar spine were studied using CT and/or MRT. In the first group of patients we used standard methods (physiotherapy, massage), to which we added intravenous introduction of ozonized physiological solution 250 ml per day by direct sparging. Course duration — 10 procedures. Ozone was produced by ozone generator «Medozons-System». In the second group of patients with acute pain we spent a treatment the type of blockade: a single-dose of ozone-oxygen gas mixture with a concentration of 4000 mcg/l paravertebral subcutaneously. It was shown that ozone therapy is an effective and universal method for the relief of acute and chronic back pain.

Conclusions

Ozone therapy is sufficiently efficient to treat sharp and chronic back pains.

Key words: neurology, back pain, lumbalgia, ozone therapy, direct sparging, subcutaneous administration, blockade, chipping

PATHOGENETIC BASIS OF EFFICIENCY OF COMBINED USE OF OZONE AND OF THE DRUG "VAGIFERON" IN PATIENTS WITH BACTERIAL VAGINOSIS

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Introduction

One of the most common types of infectious diseases of the genital organs in women is bacterial vaginosis (BV).

The **aim of our investigation** was to evaluate the effectiveness of therapeutic action of medical ozone in combination with vaginal suppository "Vagiferon" in patients with BV.

Materials and methods

50 patients with a diagnosis of BV were assessed. 30 of them (1st group) received vaginal insufflation of ozone-oxygen mixture with ozone concentration 5000 mkg/l, No 7. Along with the ozone therapy these patients used vaginal suppositories Vagiferon (10-days course). 20 patients of the 2nd group received conventional treatment. Clinical efficacy of therapy was evaluated on the basis of complaints of patients and the results of microscopy, biochemical parameters of the vaginal secretions, immunologic tests.

Results

We have shown that combined treatment effectively prevents clinical symptoms of BV: complaints of a burning sensation, discomfort in the vagina, abundant discharge with "fishy" odor, dyspareunia. 100% of women at the end of treatment demonstrated normalization of the vaginal biocenosis. It is also known that BV is characterized by abnormalities in the biochemical composition of vaginal secretions. We found that initial levels of sodium and chlorides were increased, while calcium, glucose and iron were reduced. The treatment had a normalizing effect on the parameters under study. In particular, the concentration of Na⁺ was reduced to 72,2±3,7 mmol/l, i.e. by 40%, the concentration of chlorides was reduced to 65,5±4.0 mmol/l, i.e. by 31% (p<0,05 in both cases). The level of Ca⁺ increased to 9,23±0,15 mmol/l, i.e. by 34%, glucose to 4,85±0,11 mmol/l, or 60,2%, iron - up to 384,8±8,2 mmol/l, or by 38,1% (p<0,05 in all cases), which indicates an improvement of the biochemical composition of the vaginal secretion. It is known that one of the immunological criteria for BV is an elevated level of transferrin. According to our data, the level of transferrin was 168,0±10,3 g/l, which is characteristic of this pathology. In the process of therapy, we found that transferrin was decreased to 19,0±1.1 g/l, i.e. 8,8 times (p<0.05) in the I group. In the second group the level of transferrin dropped slightly.

Based on the fact, that BV, being recurrent, is one of the most intractable problems, we followed up our patients for 1 year after the treatment. In 6 months, the recurrence of BV was observed in both groups, but in the first group it was 3.8 times less frequent than in the second group. After 12 months of observation, it was found that in the first group the recurrence rate was 2,5 times lower compared to group 2 .

Conclusion

Therefore, we believe that treatment of BV with a combination of vaginal insufflation of ozone-oxygen mixture and interferon containing suppositories Vagiferon gives positive results, relieving the main symptoms, restoring biocenosis of the vagina and of the balance of biochemical and immunological parameters of vaginal secretions. This scheme of treatment is pathogenetically grounded and solves an important problem, significantly reducing the frequency of recurrence of BV within 1 year of follow up compared with standard treatment.

Key words: bacterial vaginosis, vaginal insufflation of ozone-oxygen mixture, local immunity

The possibilities of ozone therapy at patients with ventral hernias

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The treatment of patients with gigantic hernias poses one of the biggest problems in modern surgery. The use of reticulated endoprosthesis allows covering the defect of hernias even in most difficult cases. However, the progress of postoperative period is implicated by suppuration of postoperative wounds, great quantity of infiltrates and seromas. The operation injury and limitations to movement lead to an intensification of accompanying chronic diseases.

The intra- and postoperative use of ozone therapy allows to a significant extent lower the risk of complications and contributes to the intergrowth of reticulated endoprosthesis by connective tissue and granulations.

In total there were 57 patients under our supervision who were operated concerning gigantic ventral hernias. The study group included 27 patients and the group of control – 30. In the control group the operative treatment and medical therapy were carried out by common standards. In study group the traditional technologies were complemented by ozone therapy. The groups were comparable by the age and accompanying diseases. The operative invasion included the operative access, implantation of reticulated endoprosthesis, drainage and application of postoperative sutures. With the aim of prophylaxis of postoperative complications, the edges of the wounds were treated by ozone-oxygen composite with the concentration of 80 mg/L. The operational wound was debrided in ozonated distilled water in the volume of 5 liters with ozone concentration of 4-5 mg/L. During proliferative phase the drainage perforations were tied with the application of ozonated oil Otri 6000 on the wound surface. In postoperative period the patients were given 5 sessions of autohemotherapy. With the aim of studying the impact mechanisms of the autohaemotherapy on macroorganism, the atomic force microscopy of red blood cells of patients who have been operated on account of gigantic postoperative hernias has been carried out.

During visualization of erythrocytes there could be seen a great quantity of its transformed forms. Judging from the way it appears to be, this phenomenon is associated with the movement damage of biological membranes as a result of activation of free-radical oxidation. The accumulation of products of peroxide oxidation of lipids in membrane led to a reorganization of its structures, the formation of sedentary conglomerates, lipid clusters, which restricted the displacement of protein molecules, changed the rigidity of biological membranes and deformed their surface.

The structure of biological membranes was ameliorated against the backdrop of ozone therapy, and even surpassed by elasticity its analogous parameters before the treatment. During the analysis of erythrocytes diameters in study groups, there was no trustworthy data gained.

The application of ozone therapy allowed to shorten the time of patients stay in the hospital, decrease the number of purulent complications and seromas in postoperative period.

Key words: ozone therapy, surgery, ventral hernia

Dynamics of lipid hydroperoxides' content in alveolar macrophages influenced by model suspensions of atmospheric solid micro-size particles

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Solid suspended particles (also called particulate matter or PM) contained in the air have an adverse effect on the human body; the most dangerous particles are PM₁, PM_{2.5} and PM₁₀ inducing increased production of ROS. PM have an impact on macrophages, which are the main phagocytic cells in the respiratory system. At this point the complex influence of air microparticles on lipid peroxidation in alveolar macrophages is studied insufficiently. The **purpose of the study** is to evaluate the state of peroxidation's processes in alveolar macrophages influenced by model suspensions of atmospheric solid micro-size particles.

Material and methods. 17 Wistar rats are used in the experiment conducted in accordance with the bioethical norms of maintenance and euthanasia of animals. Bronchoalveolar lavage was selected, alveolar macrophages were singled out. Loading tests were performed on cells with model suspensions of PM, whose composition of particles are identical to ambient air of Vladivostok districts with minor (model suspension № 1) and high (model suspension № 2) technogenic load. Three groups of cultures were chosen: the first group was intact, the second one was loaded with the model suspension № 1, the third one was done with the model suspension № 2. Lipid hydroperoxides (LHP) were determined in heptane-isopropanol extracts. The study of GPL was performed in cell cultures and the culture medium after loading tests. Statistical analysis was realized with the program "Statistica 6.0", module "Nonparametrics".

The level of LHP in the third culture is statistically different from other groups: in the cell culture it is increased by 51% compared with the first group ($p = 0.03$), in the culture medium it is done by 33% compared with the second group ($p = 0.03$). The first group does not differ from the second one in the total content of LHP in the cell culture and the culture medium, but in the third group the difference is statistically significant: increased by 30% ($p = 0.05$) and 38% ($p = 0.01$) compared with the first and the second groups accordingly. It is possible that the solid suspended particles contained in the model suspensions for the third group and phagocytized cells enhance generation of ROS by macrophages and, as a consequence, the lipid peroxidation.

The membrane lipids' oxidative modification of macrophages, probably, is associated with the mechanism of pathological action of big number of fine fractions' particles phagocytizing by macrophages and contained in the model suspension № 2, but contained in the model suspension № 1 in a small account.

Key words: lipid hydroperoxides, alveolar macrophages, peroxidation

Trigger mechanisms of membrane destruction in the progression of surgical endotoxemia

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Introduction

Destructive pancreatitis still severe disease. Lethal outcomes in the early hours from the onset of the acute pancreatitis determined by hard pancreatogenic combined endotoxemia. Severity of endogenous intoxication in acute pancreatitis depends not only on the character of the pancreatic inflammatory process, but also on the detoxification system functioning, at first liver.

Material and methods

The study is based on experimental studies on adult mongrel dogs (n = 20). In the first group (n = 10) we modeled acute edematous pancreatitis, in the second (n = 10) group – acute destructive pancreatitis. We performed sampling of blood flows to the liver and flows out of it, a biopsy of liver tissue in the control periods (1, 3, 5-days). We identified some markers of endotoxemia in blood, the severity of lipid peroxidation and phospholipase A2 activity in the liver tissue and membrane lipid composition of hepatocytes. We analyzed the obtained results with the method of variation statistics using Student's t test, correlation dependence assessed by the ratio r.

Results

We found that the functioning of the liver is not seriously disturbed in the edematous form of pancreatitis. The liver is capable enough to eliminate toxic products from the blood since the third day of the experiment. We found that in the liver tissue in edematous pancreatitis recorded a small increase in the intensity of lipid peroxidation and phospholipase activity. These processes does not significantly modify the composition of the phospholipid bilayer of the cell membrane.

We have recorded a progressive increase in the content of hydrophilic and hydrophobic toxins in the blood plasma with the dynamics of pancreatic necrosis. Assessing the level of toxins in the blood flowing in and out of the liver allow to identify fundamentally important fact. Concentration of toxins in the blood when disease worsens not only reduced when the blood passes through the liver, but also increased. These data indicate the formation of severe hepatic failure, liver and itself becomes a source of toxins. A sharp increase in the intensity of lipid peroxidation (on 63.2-190.0%) and phospholipase activity (144.0-262.6%) observed in liver tissue. We consider that this is the trigger for a significant modification of the phospholipid bilayer composition of the cell membrane.

Conclusions

1. Progression of endotoxemia in severe acute pancreatitis is defined not only a violation of the liver detoxifying function, but the supply toxins from the liver tissue.
2. The destruction of membranes play an important role in the pathogenesis of the liver dysfunction. The main triggers of membrane destruction in this urgent surgical disease are the excessive activity of lipid peroxidation and phospholipase A₂.

Key words: acute pancreatitis, membrane destruction, lipid peroxidation

EPR STUDY OF NITRIC OXIDE PRODUCTION CHANGES IN TISSUES OF HEART AND LIVER OF RATS UNDER HYPOKINESIA: EFFECTS OF INHIBITORS OF NO-SYNTASES

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The system of nitric oxide (NO) is one of the most studied systems of the body. NO is continuously produced by constitutive and inducible NO-synthases (NOS). NO controls vascular tone, blood pressure, participates in the occurrence of atherosclerosis and hypertension. Dysregulation of cerebral blood flow and supply of the heart by blood and associated changes in NO production can result in ischemia of brain and heart with subsequent development of insult and infarct. It is also shown that NO plays an important role in adaptation of organism to different environmental changes and external conditions. These data demonstrate the involvement of NO in the regulation of physiological functions in various tissues. In present very actual the problem of hypokinesia (HK). During HK occurs the reduction the load on the muscular system, which leads to changes of functional and morphological properties of the tissues up to pathological states depending from the duration and degree of HK. During reducing of physical activity significantly decreased the consumption of oxygen by tissues and the activity of oxidative processes. On this basis, the aim of the study was to investigate the possible changes in the NO production under HK through analysis of the NO content in different tissues of rats, which grew in conditions of limited physical activity.

The experiments were performed on albino rats. Hypokinesia were begun 21 days of age: the first two days of the time of HK was 1 hour, and further increased by 2 hours every 2 days. By the 25th day the time of animals staying in cages-canisters reached 23 hours, and subsequently remained constant until 60 or 90 days. In a separate series of experiments before the measurements of the level of NO production in rat tissues for determination of the sources of NO production in HK (various NOS) used non-specific NOS inhibitor L-NAME at a dose of 10 mg/kg. For selective blockade of inducible NO synthase, aminoguanidine was used at a concentration of 10 mg/kg L-NAME and aminoguanidine were injected 60 min before decapitation. Registration of NO production was made by the method of EPR spectroscopy. In our work, as spin trap has been applied the complex of Fe²⁺ c diethyldithiocarbamate - (DETC)₂-Fe²⁺-NO. This complex is characterized by easily recognizable EPR spectrum with g-factor g=2.035 and triplet hyperfine structure.

It was found that the quantity of NO produced in the tissues of the heart and liver of rats increases after 60- and 90-th day hypokinesia in 2 times compared to control rats of the same age. The use of non-selective inhibitor of NO-synthase L-NAME at hypokinezied rats led to decrease of the NO content in heart and liver tissues to 67-70%. Selective inhibitor of inducible NO synthase, aminoguanidine also caused a reduction of the NO content in heart and liver tissues in 60-65%. The results indicate that the increase in NO production during hypokinesia is due by the activation of NO-synthase.

Thus, the obtained results allow to conclude that the presence of close relations between the level of NO in the body with a regime of physical activity. Because the review of literature data shows that HK causes the significant changes in the cardiovascular system, internal organs, blood flow and supply of oxygen, it can be assumed that part of these changes is called a stationary increase of NO production in key activities of the body tissues.

Key words: nitric oxide, heart, liver, rats, hypokinesia

EFFECT OF OZONE ON COLLAGEN METABOLISM IN TRAUMATIC DAMAGE OF KNEE JOINT

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Introduction

The treatment of traumatic damages of joints leading to the development of deforming arthrosis and disability of the patient, remains one of the most relevant issues of traumatology [3,4]. The development of post-traumatic arthritis is accompanied by disorder of microcirculation and hypoxic disorders, which are the prerequisites for the free radical processes activation, causing oxidative destruction of cells and of extracellular matrix of articular cartilage, depolymerization of synovial liquid, decomposition of hyaluronic acid, proteoglycans and of collagen. Considering the pathogenetic mechanisms of development of acute aseptic post-traumatic arthritis, the most reasonable method for complex treatment of the pathology is the use of local intraarticular ozone therapy.

Objective:

to study certain parameters of collagen metabolism in patients with traumatic knee joint damage when using intraarticular ozone therapy.

Materials and methods

We performed the follow-up of 126 patients with traumatic damage of knee joint treated at the traumatology department of Mordovia Republican Clinical Hospital in the period 2009-2013. Depending on the treatment performed in the post-operational period the patients were divided into two groups with similar damage type. The patients in group I (n=64) underwent traditional treatment, including non-steroid anti-inflammatory therapy, drugs for improving microcirculation, disaggregants, physical therapy procedures. The patients of group II (n=62) along with traditional therapy in the post-operational period underwent intraarticular infusion of ozone-oxygen mixture every other day in amount 20 ml with ozone concentration at exit from ozonizer 15 mg/l. The treatment course consisted of 5 injections. In the patients of this group the surgical intervention ended by lavage of articular cavity with sterile ozonized solution in concentration 2 mg/l. Our work utilized Medozons Univesal ozonizer. All the patients gave their written consent for performance of therapeutic procedures. The state of collagen metabolism was evaluated based on content of free (FO), peptide-conjugated (PCO) and protein-conjugated oxyproline (PrCO) in blood plasma. The significance of the differences between groups was evaluated using Student's t-test, where P reflected the significance relative to the reference values, P_1 – significance relative to the data at admission to the in-patient facility.

Results and discussion

When studying the content of free and conjugated oxyproline fractions in blood serum in healthy volunteers we got the results which do not contradict the literature data, i.e. the FO concentration was 12.55 ± 0.61 $\mu\text{mol/l}$, PCO – 8.79 ± 0.36 $\mu\text{mol/l}$, PrCO – 53.47 ± 3.95 $\mu\text{mol/l}$. PCO/FO ratio, reflecting the metabolic collagen turnover, was recorded on the level 0.70 ± 0.04 . The patients with traumatic damage of knee joint at admission showed the increase of all the oxyproline fractions: free oxyproline concentration – by 138.09% ($p < 0.001$), peptide-conjugated concentration – by 100.57% ($p < 0.001$), protein-conjugated oxyproline – by 13.62% ($p > 0.05$), respectively relative to the data from healthy volunteers. At the same time PCO/FO ratio, on the contrary, decreased by 15.71% ($p < 0.05$). Gross increase of blood serum FO and PCO and decrease of PCO/FO ratio reflects the prevalence of catabolic processes in collagen metabolism, the increase in PrCO level characterizes the start of the connective tissue fibers synthesis.

With traditional therapy there was the tendency towards decrease of free oxyproline content in blood serum by 15.90% ($p_1 < 0.05$) compared to the data at admission. Peptide-conjugated and protein-conjugated oxyproline increased by 42.20% ($p_1 < 0.001$) and 69.49% ($p_1 < 0.001$) relative to the data at admission. PCO/FO ratio also increased to 1.0 ± 0.11 , surpassing the admission values by 46.11% ($p_1 < 0.001$) (Tab.1). Such changes of oxyproline fractions signify the progression of destructive processes in connective tissue with increase in metabolic collagen turnover with prevailing synthesis.

Intraarticular ozone therapy allowed us to decrease the blood serum level of oxyproline fractions: free oxyproline – by 18.38% ($p_2 < 0.01$), peptide-conjugated oxyproline– by 37.0% ($p_2 < 0.001$) and protein-conjugated oxyproline – by 18.68% ($p_2 < 0.01$), PCO/FO ratio - by 23.0% ($p_2 < 0.001$) compared to the traditional therapy parameters.

Conclusion

While the traditional therapy causes the significant decrease of destructive changes in connective tissue by the end of treatment, it also preserves the disruption of dynamic balance between synthesis and disintegration of collagen towards increased collagen biosynthesis (PrCO, PCO). Such a change of collagen metabolites signifies fibrillogenesis, intensity of which does not correlate with the degree of collagen fiber disintegration. The injection of ozone-oxygen mixture directly into the damaged joint as part of complex treatment leads to more significant decrease in collagen disintegration and limitation of excess accumulation of collagen fiber, aiding in earlier restoration of internal medium of the joint and slowing down of sclerotizing processes in damaged joint.

Key words: traumatic damage of knee joint, ozone, collagen, oxyproline

EFFECT OF CORRECTION IN THE INTRA-ARTICULAR OZONE CYTOKINE IMBALANCE IN EXPERIMENTAL POSTTRAUMATIC ARTHRITIS

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The aim of this study was to evaluate the effect of intra-articular ozone therapy on some parameters of the cytokin profile and changes the cellular composition of the synovial fluid in the experimental post-traumatic arthritis. Experiments were carried out on 132 white non-linear rats of both sexes weighing 180-200 g. It was found that oral enteral administration of nimesulid in combination with intra-articular injection of ozone had a significant effect on the cytokin profile, helping to reduce the activity of the inflammatory response, defined by a decrease in pro-inflammatory and anti-pools of cytokines, bringing their data intact animals.

Key words: post-traumatic arthritis, cytokines, nimesulid, intraarticular ozone therapy

THE INFLUENCE OF SYSTEMIC OZONE THERAPY ON MICROCIRCULATION STATE AT PATIENTS WITH ALCOHOL WITHDRAWAL SYNDROME

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The **aim of this work** was to estimate the effect of the systemic ozone therapy on microcirculation in patients with alcohol withdrawal syndrome (AWS).

Material and methods

We studied the functional state of healthy people and patients with alcohol dependence (in the phase of withdrawal syndrome). The main group consisted of patients with AWS in the dynamics of its relief with the use of conventional scheme with a course of systemic ozone therapy. The comparison group included practically healthy people who do not have substance abuse history (n=30). Group of patients of narcological profile was divided into two subgroups. Patients of the first subgroup (n=45) received standard regimens of alcohol withdrawal, the correction of the second subgroup of patients (n=45), in addition to the standard events included a course of systemic ozone therapy (intravenous injection of ozonized physiological solution with ozone concentration 4000 µg/l, 10 daily treatments).

Exclusion criteria from the study were: the presence of hemodynamically significant somatic pathology, presence of hypertension; the presence of clinical signs of heart failure; the presence of diabetes. All the subjects at the time of inclusion in the study underwent clinical and instrumental examination.

Microcirculation was assessed using laser Doppler fluometry apparatus "LAKK-M" ("Lazma", Russia). The intensity of blood flow in the microvessels was estimated by the microcirculation index, the activity of regulatory mechanisms at the level of the respective components and the nature of the inclusion of shunt paths on the value of the indicator bypass.

Results

We stated that the addition of standard algorithm of the relief of alcohol withdrawal syndrome with a course of systemic injections of ozonized physiological solution promotes accelerated normalization of the microcirculation. This effect had a maximum expression in the most hemodynamically significant period – from 4 to 9 days after discontinuation of alcohol. It should be noted that this effect is ensured mainly by the activation of the "internal" factors of regulation of microcirculation, primarily of the endothelial and neurogenic ones.

Key words: alcohol withdrawal syndrome, ozone therapy, microcirculation