

The operating instructions for the application aero-cryo-therapy

(It was developed together with the specialists by Medical academy after diploma formation in 1998).

Cryo-therapy [kryos- cold; therapya - treatment (Greek.)] - the division of physiotherapy including physical methods of the treatment, distinguishing feature of which, is the application of cold as the basic acting physical factor. The application of cold with the therapeutic purposes is known from the times of antiquity and reference about the medicinal action of low temperatures, in particular soothing and antipyretic effect, they are encountered even in the works of Hippocrates and Avicenn. The traditions of cold treatment found their continuation and development in the subsequent epochs of the development of medicine (Celsius, Galenus, Virkhov, Samoylovich, Pirogov and others).



Hippocrates (460-377 B.C.)



Anders Celsius (1701-1744)

Studies of the last years showed the high therapeutic possibilities of extremely low temperatures.

The most rigid cooling effect possesses liquid nitrogen, which causes the coagulation of proteins and cryo-destruction during the putting on the cloth even with the short exposures. Considerably soft cooling effect of the gaseous media, heat capacity and thermal conductivity of which is repeatedly lower than in solid and liquid coolants. This specifies the large therapeutic latitude of the CT methods, based on the application of gaseous media as the refrigerants. The principle of cooling organism or its individual parts by the air- gas media

of extremely low temperatures is the basis of the new method of cold treatment - **aero-cryo-therapy (ACT)**.

Priority in the field of uses ACT belongs to the Japanese researcher Taimo Yamauchi, who in 1981 substantiated the application of a cryo-therapy in the treatment of patients by rheumatoid arthritis. The essence of this method consists in the creation of the short-term contact of the patient body with the gaseous medium of extremely low temperature 90 -100 K (- 180 -170 °C).

General ACT provides for the total or subtotal immersion of the patient naked body into the gaseous medium of cryogenic chamber at a temperature of -110 -180°C. In the majority of the cases (with the total immersion) for the respiration of patient is used air, which fills the zone of cryogenic effect, thinner frequent (with the subtotal immersion) patient breathes by surrounding air, which is ensured by the closure failure of the therapeutic outline of cryogenic chamber. Taking into account the descending distribution of cold gas flows and the possibility of the development of cold aero-effects, and also the high sensitivity of mucous membranes of the respiratory tract to cold air, the distal divisions of extremities and the respiratory organs protect from the freezing. General ACT possesses the more expressed therapeutic action.

Conducting the procedures of general ACT requires special cryogenic equipment. Installations for the general ACT are the complex medico- engineering system, necessary components of which are device for the cleaning, the draining and the cooling down to extreme temperatures of the prepared gaseous medium, procedural cabin for positioning the patient and device for the forcing of gaseous medium into the cabin.

The preparation of air, in particular preliminary draining, it is necessary for the exception of the possibility of the cryogenic damage of the body covers (the skin and mucous membranes) by the crystals of ice, which cause freezing. The presence of moisture considerably increases heat capacity and thermal conductivity of air, which decreases the comfort of cold procedures and makes their conducting by impossible under the conditions of extreme temperatures.

Cooling gaseous medium is achieved in the heat exchangers of different construction, in which occurs boiling liquid nitrogen. The dried and cooled gas is forced into the procedural cabin, where the action on the patient can be achieved by both the static gaseous medium and by horizontal, vertical, spherical or spiral jets of cryogenic gas. Installations for the general ACT produce firms "Nihon Sanso" (Japan) and "Messer Griesheim". In Russia (St. Petersburg Academy of cold, Saint Petersburg) is developed original installation for the general ACT and prerequisites for its production on the basis of patent RF are created.

MECHANISMS OF THE PHYSIOLOGICAL AND THERAPEUTIC ACTION AERO- CRYO-THERAPY

One should recognize that the thin mechanisms of the cold stimulus action on different biological structures at the subcellular`s, cellular`s, organ`s, system`s and organism`s level are studied insufficiently. This entirely concerns the complex of therapeutic factors of ACT. Data of infrequent experimental works indicate that the short-term cold action leads to retarding of oxygen metabolism, processes of the oxidizing phosphorylation of glucose in the

integumentary cloths, reduction in the intake of oxygen and of nutrients with cells, retarding of the transmembrane transport of cellular metabolites. These changes bear the reversible nature and are developed in the cloths "layer" of the body as a result of the direct action of cold factor.

Phenomena, which are developed in the deeply located cloths "nucleus", are not connected with the straight influence of cold stimulus and have second - reflectoral and neurohumoral origin. From the centuries-old practice of people medicine and newest CT experience, including ACT, are well known the positive effects of the dosed cooling to the human organism within the standard and under the conditions of pathology. The number obvious includes the generally training (weathering/ quenching) effect, which is manifested by an increase in the level of the functioning of the main regulator systems of organism in the clinically healthy persons. Under the conditions of pathology is manifested anaesthetizing, antipyretic, vasodilates, and myorelaxing action of cold.

The generally training (weathering) effect of ACT is based, first of all, on appearing reconstruction of the activity of cardiovascular, peripheral nervous and neuroendocrine systems.

The action of cold ACT in the form gives to the expressed phase changes in the activity of peripheral vessels, which is manifested by the spasm of small arteries and arterioles, precapillary sphincters, by retarding the speed of blood flow. The maximum contraction of the skin vessels is noted under the influence by the gaseous medium with the temperature of -170°C during 2 minutes. In this case occurs instantaneous reduction in the temperature of the skin of $0^{\circ} - 10^{\circ}\text{C}$, the contraction of skin vessels during 20 minutes after which continues. The contraction of skin vessels is first shielding phase of the vascular reaction for the extreme cooling, directed toward averting of the penetration of the cold factor through the covers (layer) of body toward the internal cloths (nucleus) of body.

Then is developed the second shielding phase of the vascular reaction in the form expressed expansion of peripheral arterial vessels, which leads to active arterial hyperemia, whose duration varies from 1 to 3 hours, depending on the intensity of cooling. The second vascular phase is compensating, it contributes to the intensive heat generation, prevents ischemia and to the damage of the nourishment of cloths. As a rule, vasodilatation in the second phase of vascular reaction bears the clearly expressed nature, it is manifested by the sharp turning pink of skins, by an increase in the skin temperature to 35°C (normal mean temperature of the skin of 32.5°C). The consequences of cryo-therapy are visually manifested by a change of painting the skins after the procedure in the form spilled, bright and steady erythema. The system expansion of integumentary vessels stimulates the work of the apparatus for blood circulation, it improves nourishment and oxygenation of all tissues of organism, hemodynamic load on the heart muscle is reduced. Together with changes in the arterial and capillary blood circulation ACT gives the moderate improvement in the venous draining and with the therapeutic exposures it does not give to with the phenomena of venous stagnation.

Staging of the vascular reaction of organism for the cooling with ACT can be more complex, multiplying the intermittent phases of contraction and vasodilatation, depending on the individual reactivity of organism. The reaction of the vessels of the deeply placed organs and tissues to the extreme cold stimulus is less expressed than the reaction of skin vessels;

however, a number of the authors showed that the procedures of general ACT lead to strengthening of the blood supply of internal organs, what is connected with the formation of vaso-active substances in the vessels "layer" of body with the cryogenic effect, the development axon - reflexes, with reduction in the muscular tone.

General ACT does not cause noticeable changes in the central hemodynamics, it does not present the increased demands to the activity of heart, it does not provoke the development of myocardium ischemia, disturbances of cardiac rhythm and conductivity, is not caused a considerable increase in the arterial pressure in the course of procedure. This makes it possible to allow to the procedures of patients with the associated cardiovascular diseases in the initial stages, and to also enlarge the framework of the application of a method for the patients of elderly and even senile age. For these patients, and also for the clinically healthy persons phase changes of state of the vessels "layer" of body give the adequate training load to the system of blood circulation. The system prolonged expansion of skin vessels in the second phase of vascular reaction, which appears after procedure, causes reduction in the general peripheral vascular resistance and, thus, decreases pre- load on the heart, what is contributory factor for the patients of cardiological profile

Extreme cold stimulus actively acts on the state of peripheral nervous and muscular systems. The effects of general ACT are connected with a change of skin state receptors and reduction in the tone of the transversostriated muscles, removal of muscular spasms. In this case skin receptors answer the cooling phase reaction with the short-term primary phase of excitation and prolonged second phase - increasing braking, which is subjectively manifested by the bright sensations of cold and burning at first of procedure and by anesthesia and analgesia at the end. The development of the cold anesthesia of skin receptors is the partial explanation of the anaesthetizing action of ACT. The reversible phase changes in the functional state of the receptor apparatus of the skin are one of the factors, which lie at the basis of the general- training and preventive action of method.

General ACT regularly leads to reduction in the tone of the transversostriated muscles and removal of muscular spasms. Since the short-term action of cryogenic gas does not cause direct considerable reduction in the temperature of muscles and nervous is trunk the, it is obvious, that myorelaxation effect of ACT it is define by exampled reflector through the external receptors of the skin apparatus and the gammamotoneuronic system. Cooling the skin, which appears under the effect of the cryogenic gas, is completely sufficient for the minimization of the functional activity of the external receptors of the skin, reduction in the mono-synaptic excitability of spinal cord and motor reaction. This ensures myorelaxation and removal of muscular spasms. Influence of ACT on the muscular tone contributes to strengthening visceral blood circulation and to decrease the pain by the diseases of supporting-motor apparatus and peripheral nervous system.

To the number of the most important aspects of the physiological action of extreme cold by ACT relate changes in the activity of the highest vegetative centers and systems of neuroendocrine regulation, which directly correspond for the temperature homeostasis of organism. The reaction of this complex ensemble of the highest neuroendocrine regulator mechanisms for the cooling with ACT is studied insufficiently. However, clinical observation and the evaluation of objective data of the functional studies, conducted in the dynamics of the course of treatment obvious that the utilized with ACT physical parameters of action on

the organism do not cause the overvoltage of the central mechanisms of thermostatic control. On the contrary, general ACT renders on them the undoubted training action.

According to the number of researchers data, short-term cooling by gaseous medium at a temperature of -120°C ... - 180°C leads to the activation of adrenocorticotrophic system with strengthening of production ACTH with the front share of hypophysis and hydrocortisone with the adrenal cortex. Specifically, by strengthening cortical production are explained noticeable improvements in the state of the patients with rheumatoid arthritis and by some other rheumatic illnesses, which occur with ACT.

The liquidation of muscular constraint partly is also caused by relaxation and removal of the spasms of the transversostriated musculature. According to published data, during the extreme cooling sharply rises the production of the endorphins, which possess the powerful anaesthetizing action, the sedative and moderate euphorogenic effect. Similar hypotheses explain well the reversible anaesthetizing action of general ACT, that bears the generalised nature and not dependent on the genesis of pain.

Thus, general ACT actively acts on the state of cardiovascular system, rendering the training action on its central and especially peripheral components, activating blood circulation predominantly in the arterial elbow and in the microcirculatory river bed. The proceeding salvo stimulation of the apparatus for blood circulation has important significance for the preparation of organism for the extreme conditions of vital activity, and an improvement in the visceral blood supply - favorably acts on the function of all internal organs. With the common ACT rises the functional lability of the skin receptor apparatus and neuromuscular instruments, is strengthened the activity of neuroendocrine structures, which increases the possibilities of the adaptation of organism to the changing ambient conditions.

The therapeutic aspects of the action of general ACT are reduced, first of all to the expressed anaesthetizing action of the general nature, obliged by its origin of the cold anesthesia of receptors and stimulation of the endorphins production, to antipyretic and against to rheumatic action, apparently, connected with strengthening of endogenous hydrocortisone production, intensive vasodilating and myorelaxing effects.

The experience of the practical use of cryo-balneotherapy in the conditions of multiprofile medical establishment showed a number of the new directions of the possible application of cryo-balneotherapy. In particular, distinct positive effect is obtained in the patients with psoriasis, by neurodermatites, by bronchial asthma, by the consequences of burns. Patients from the narcologic profile in the period of abstinence syndrome give the expressed positive reaction to the cryo-procedure. The latter fact can serve as the indirect confirmation of hypothesis about endorphin antilogarithmic mechanism of physiological action ACT, in connection with the fact that the pathogenesis of abstinence syndrome is connected with the unbalance of the most important mediators of brain and, not lastly, with the scarcity of the production of endorphins.

GENERAL PROCEDURE OF ACT

The procedures of general ACT is conducted in the specially equipped accommodation – cabinet of ACT - with total area not of less than 24 m², that has isolated section- changing room and procedural cabinet. Changing room is equipped with boxes for storing of clothing and linen of patients, stools, auxiliary inventory. Procedural cabinet have an area not less than 18 m² in it is placed apparatus for ACT (cryochamber KAEKT-01), which consists of the cryogenic installation and the procedural camera, or procedural couch for the preliminary inspection of patients, table of procedural nurse, place for distribution of operating personnel, which operates cryogenic installation, box with the collection of drugs for the rendering to pressing medical aid. During the session the patient is placed in the heat-insulated procedural camera, which is executed according to the principle of the open therapeutic outline, i.e., it is not closed on top. This provides the possibility of the respiration of patient with surrounding air, in connection with the fact that the flow of cryogenic gas descending. Procedural camera is supplied with the tightly closed fold (door) for entrance and output of patients. For the evacuation of cryogenic gas, cabinet ACT is equipped with suction and exhaust ventilation. Before the cabinet of ACT equips recess for the expectation and for leisure of patients after leave of procedure.

Patients are shipped for the general procedures of ACT by the doctor, who passed preliminary preparation according to the specific routine, who determines indications and contra-evidence to this form of physical treatment. The general procedures of ACT carries out average medical worker the constantly being present in the cabinet of general ACT. The real-time control of the work of cryogenic installation is achieved by the authorized operating personnel. Responsibility for the work of the cabinet of general ACT is laid on the doctor.

Before the procedure for patient is recommended preliminary leisure in the recess during 10-20 minutes for the adaptation to the conditions of accomodation, the normalization of the skin function (sweat) glands. The increased humidity of skins is unfavorable background factor for conducting the procedure ACT in connection with an increase in heat capacity and thermal conductivity of the air mantle of the skin.

Average medical worker carries out inspection (measurement of arterial pressure, the control of pulse) and the instruction of patients, explains the course of procedure and rule of behavior in the cabinet of general ACT. Patient goes in the procedural camera exposed (in the cowards), since outer clothing possesses high heat capacity and can considerably prolong the effects of cooling, provoke the development of catarrhal diseases. To avoid cold injury, feet and hands of patient it is expedient to protect by noses edges from the dense material, by gloves. During the procedure average medical worker supports verbal contact with the patient for the purpose of the control of his health and timely averting of the episodes of asphyxia, which can arise with the surplus of nitrogen in inhaled air.

Session is conducted with the tightly closed fold of procedural camera. Cryogenic gas will be given in the camera, in this case reduction in the temperature from 20°C to -140°C occurs during 30 s, the after which achieved level of temperature is kept constant. The duration of the general procedure of ACT composes 60 -180 s, increasing in the course of course. Normal course dose composes of 10 to 20 procedures and more if there is a need. Health-improvement (preventive) procedures are carried out daily, in a day other day or with the

interruption on each third day. During the treatment of rheumatic and other diseases an increase in the multiplicity of procedures to 2-3 times is allowed in a 24 hour period.

The general procedures of ACT are not accompanied by side effects as a rule. To this number one ought not to carry the sharp reddening of the skin, which is developed in some patients into different periods after procedure and occur as the bright manifestation of the second phase of physiological vascular reaction. In a number of cases the development of short-term cold hives is noted.

BASIC INDICATIONS TO THE GENERAL ACT

- Reduction in the general resistance of organism;
- Preventive maintenance of acute respiratory diseases;
- Preventive maintenance of cardiovascular and bronchopulmonary diseases;
- Preventive maintenance of the diseases of peripheral vessels;
- Rheumatoid polyarthritis with the preferred defeat of the joints in the active (1st st.) and inactive phase;
- Ankylosing Spondylitis (Bekhterev`s disease/Bechterew`s disease - Inflammation of spinal joints similar to rheumatoid arthritis);
- Diseases of the skin (eczema, neurodermatitis, psoriasis)
- Stimulation of immune system in combination with endocrine system.

CONTRA-EVIDENCE TO THE GENERAL ACT

- General grave condition of patient;
- Decompensation of chronic cardiovascular diseases;
- Sharp myocardial infarction and the period of rehabilitation after infarction;
- Cerebral strokes;
- Hypertonic disease I st. (AD > 180/100 mm Hg)
- Heart insufficiency I st.
- Prognostically unfavorable disturbances of cardiac rhythm and conductivity;
- Fever;
- Active pulmonary tuberculosis;
- Malignant tumors;
- Hemorrhagic diatheses;
- Hysterical neurosis;
- Individual intolerance of cold

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