AMP NONINVASIVE HEMOGRAM ANALYZER OPERATING THEORY

Malykhin A.V.
Doctor of medical science
Institute of neurology, psychiatry
and narcology of Ukraine AMS

Kharkiv, Ukraine
e-mail: inpn@ukr.net
e-mail: bioluch@yahoo.com
tel: +380677612414

Human organism is an open three-dimensional biosensor system that perceives any changes in the atmosphere by photo-, chemo-, baro- and osmoreceptors, processes the received information and transmits it through the mediator system to executive organs where acetylcholine, noradrenaline, serotonin and dophamine work as mediators. The latter determine the rate of transfer of an amount of substance from one area in the space to another one. This process is called mass transfer. A method was developed basing on kinematic laws of mass transfer and functioning of receptor and mediator and on molecular kinetic expotential relationship between response rate and temperature and transformation of temperature into radiation energy. This method is based on the connection of an organism and the environment by interaction of the enzymatic hormonal system and the hemopoietic system. It is grounded on the postulate brought in 1979 by Galzinge and Mauzuli about the relationship between physical parameters of the mediator molecules, such as dipole moment, molar refraction, and their exciting or retarding properties with respect to the course of biochemical reactions.

Developing this postulate in our method, we made theoretical evaluation of dipole moment by the vector method with the use of internuclear distance of chemical elements, relative molar mass of a substance, Xe^{86} wave length and other structural data, namely linear dimensions of cardiac and somatic capillary vessels, erythrocyte diameter, body temperature, atmospheric pressure, gas composition of atmosphere, function of mass transfer and specific conductivity which is connected with the oxygen diffusion coefficient.

The principle of operation of the AMP noninvasive analyzer is based on processing of behavior of temperature indicators in representation points (bifurcation of the carotid artery: on the left and on the right, in axillary and abdominal areas). The principle is based on the relationship between variations in oxygen diffusion coefficient, pH-environment and appearance of paroxysmal conditions.

The behavior of the above listed indicators reflects the processes of conversion of chemical connections of elements of carbon, nitrogen, oxygen and hydrogen included into the gas composition of atmosphere and biochemical homeostasis of the organism.

All chemical reactions in the organism are of exothermic nature and determine the organism temperature interconnected with the specific conductivity which, in turn, is connected with the receptor function by the synapsis conduction.

The function of synapsis conduction depends on the combination of aminoacids of which the receptors are composed.

Retarding influence on the synapsis system is produced by glycine with the specific conductivity of 27.5, exciting influence is produced by thrombotonin (specific conductivity 41.5). Acetylcholine produces both exciting and retarding influence on the system (specific conductivity 52.5).

Practically, the receptor-mediator function is an obligatory manifestation of any paroxysmal vegetal syndrome with crisis course caused by the changes of glucose and thrombotonin synthesis. Vegetal paroxysmal conditions result from the changes in the activity of glucagon and insulin which depend on conduction of mediator system determined by mass transfer. In general, interaction of arginine and glutaminic acid is a frequent manifestation of adaptation disorder. The principal factors here are concentration of substances and temperature which reflect the regulatory function of glycogen and insulin and functioning of non-specific integrative brain systems. Those systems determine thermal capacity and thermal conductivity of blood, and the required hemogram, respiratory and cardiac rates by phase substance transitions.

Phase substance transitions are interconnected with blood circulation by peripheral blood composition regulating the required specific conductivity by changing nitrogen metabolism which is reflected by changes in glycogen, fat and protein metabolism. Circulation of blood in the gastro-intestinal system and hypothalamic-pituitary axis is connected with the function of aminoacids: glutamate, arginine, aspartate, glycine. When interacting with each other, aminoacids use oxygen activation (temperature related) to provide synthesis of lactic acid, etc.

As it is demonstrated by the comparative analysis of clinical, biochemical and instrumental methods of examination, the final objective of vegetal regulation of homeostasis is the systematic organization of activity of the internal organs and non-specific regulatory brain systems achieved by optimization of the transport

and gaseous metabolism function of the blood system and blood circulation, maintenance of quite definite partial oxygen stress in the circumference of each capillary vessel (35-40 mm Hg that corresponds to 65-75% of hemoglobin saturation with oxygen at normal pH and pCO_2).

Partial oxygen stress in the circumference of each capillary vessel appears only at certain thermal capacity and thermal conductivity values which determine conduction and concentration of lactic acid. This systematic organization of the course of reactions results in regulation of PVT (pressure, volume and temperature) and osmotic pressure determined by the difference of concentrations of substances that can be soluble in liquids separated by a semipermeable membrane containing lipide-protein complexes that determine the speed of oxygen conduction and CO_2 egestion by changing the conductivity of glycine, thrombotonin and dophamine which are the regulators of pH environment. These aminoacids are connected with blood circulation in the gastro-intestinal system and kidneys by changes in sodium-potassium metabolism.

The degree of manifestation of blood circulation disorders is connected with the disorders in the transport and gaseous metabolism function of erythrocytes and depends on the properties of globin and valency of ferrum (determined by oxidation-reduction processes in aminoacid – glycine), which depend on temperature indicators in active points.

Any deviations in oxygen delivery rate and CO_2 formation are accompanied by changes in biophysical and morphometric characteristics of cardiac-respiratory system, gastro-intestinal system, liver, kidneys and by changes in functional condition of regulatory non-specific mechanisms of the nervous system. These deviations are accompanied by the changes in temperature indicators in active points, time of their stabilization and changes of activity of trombin-plasmin system (TPS) due to the changes in thrombocyte activation factor.

The thrombocyte activation factor is connected with the function of carnitine and palmitic acid determining the energy metabolism depending on oxygen delivery and with the changes of its physical properties (changes of diffusion coefficient and oxygen solubility) interconnected with thermal capacity and thermal conductivity, and with number of active ions on the erythrocyte surface.

The executive mechanism in the rate of oxygen delivery to the organism involves the activity of somatropic hormone, cardiac rate, respiratory rate, minute circulation volume, stroke volume, general peripheral vessel resistance, and arterial blood pressure. Each of these quantities is stipulated by phase substance transitions from gaseous to liquid and crystalline state on one hand; on the other hand these phase transitions are determined by the distribution of minute circulation volume in the blood circulation system of internal organs having certain enzymatic directionality and activity. There is direct relationship between minute circulation volume, stroke volume and general peripheral vessel resistance realized in temperature indicators of active points. The values of these temperatures interconnect the values of heat generation and work. Changes of these indicators results, first of all, in changes of minute circulation volume and vital lung capacity. The resulting variety of chemical transformations of gaseous components depends on the constant values in reactions of three types:

- rate of reaction with charge transfer;
- rate of reaction with atom transfer;
- rate of reaction of dissociative recombination.

All these reactions are connected with the oxygen solubility coefficient and are possible only when the energy is extracted by heat emission which is finally perceived by the sensors of the AMP analyzer.

The final results of these reactions are various conversions of enzymatic groups. Enzymes of the first group of sub-class 1 catalyze oxidation of hydroxy groups to carbonyl groups, enzymes of sub-class 2 catalyze oxidation of carbonyl groups to carboxyl groups, enzymes of sub-class 3 catalyze oxidation of CH–CH group to C=C group, enzymes of sub-class 4 catalyze oxidation of $CH–NH_2$ groups that usually results in formation of carbonyl groups and NH_4^+ ion, enzymes of sub-class 5 catalyze oxidation of CH–NH groups, enzymes of sub-class 8 produce effect on donor groups containing sulphur, enzymes of sub-class 10 produce effect on diphenols and related donor groups.

Analysis of correlation dependences of content of sugar, urea and creatinine demonstrated that quantitative indicators are connected with time characteristics of cardiac cycle which are influenced by temperature indicators and which reflect the essence of retroactive effect of metabolic activity of organs on the activity of brain. This is reflected by the time of stabilization of temperature indicator in abdominal area with respect to the time of stabilization of temperature indicator in carotid area. With respect to the time of stabilization, the temperature indicators reflect the changes in oxygen transport rate which depends on the oxygen solubility coefficient. Changes in temperature indicators cause changes in oxygen solubility coefficient and cell composition of peripheral blood and changes in the course of oxidation-reduction processes accompanied by changes in trombin-plasmin system activity. It was demonstrated rather clearly that physical diffusion of oxygen is the principal driving force to deliver oxygen to arterial blood. At the stage when oxygen is transferred from capillary blood into a cell and from cytoplasm into cell organelle, more complicated oxygen transport mechanisms come into effect determining the development of certain paroxysmal disorders of homeostasis of vegetative nervous system (VNS).

We determined the relationship of the course of free radical oxidation and antioxidant protection with respect to the course of conversion of carbon, nitrogen, oxygen and hydrogen cohesive energy. We determined the relationship between the arterial pressure and metabolism determining the organism aptitude to insulin resistance. Insulin resistance determines disorders in tolerance to carbohydrates, increase of triglyceride concentration in combination with reduced concentration of

cholesterol in high-density lipoproteins and conversion of chemical energy of anhydride bonds of adenesine triphosphoric acid (ATA) into electrical energy of intracellular-extracellular metabolism of sodium and potassium. Intracellular-extracellular sodium-potassium metabolism is associated with the contractile force of cardiac muscle and muscles of vessels of internal organs which determine the influence of perfusion pressure on basal pressure of Oddi's sphincter.

The examined patients had metabolic disorders in close interconnection with structural and functional disorders in cardiac muscle. These metabolic disorders were connected with the function of the gastro-intestinal system and the value of basal pressure change. Increase of content of blood serum common lipids directly influenced the indicators of end-diastolic volume, end-systolic volume and stroke volume. The direct correlative relationship was definitely higher for the patients having a combination of cholesterol-bonded substrate with lipoproteins of very low density (r = +0.35; +0.41; +0.36). Negative relationship was observed between the concentration of blood serum common lipids and ejection fraction (r = -0.55; -0.59). An increasing relationship was detected between the concentration of blood serum common cholesterol and stroke volume (r = +0.43; +0.48).

Changes in temperature conditions cause changes of diffusion, oxygen solubility coefficient and pH environment and thus control the speed of corresponding enzymatically produced coenzymes that regulate the activity of internal organs (cytochrome P450 which is a hemoprotein and a flavoprotein at the same time). Co-proteins are controlled by the sympatho-adrenal system (SAS), hypophysis-adrenal system (HAS), thrombin-plasmin system and immunological system (thymus, spleen, lymph nodes) connected by blood circulation and biophysical parameters of cardiac muscle.

Thus, we can make two conclusions:

1. Any atmospheric changes cause changes in activity of the thrombin-plasmin system (TPS) and are accompanied by certain (often subclinical) disorders of brain vegetative regulation.

2. The degree of evidence of vegetative disorders depends on asymmetry of indicators of examined points, functional condition of systems and structures included into limbic-reticular complex and TPS accompanied by synthesis of cholesterol, triglycerides and lipoproteins of very low density.

These relationships are of universal nature and come out both in cases of stress impact, chemical and physical effects and in cases of tumors, traumas and lateralized epileptic syndromes. It should be emphasized that in emergence of clinical syndromes great role is played by the rms value of oxygen delivery rate (norm is 467 ml/s) that determines sufficiency or insufficiency of enthalpy energy to break the relationship of CO or NO. Changes of rms oxygen delivery rate are controlled by acetylcholine, adrenaline, noradrenaline and by changes in activity of erythrocytes and flavoproteins containing metalloproteins (Cu^{2+}, Zn^{2+}, Fe^{2+}). Metalloproteins determine the course of reaction

$$H_2O_2 + HO_2 \leftrightarrow H_2O_2 + O_2$$

Change of reaction course to the right changes the activity of enzymes of glutathioneperoxidase (norm is 10.46 ± 0.27 mM/l); glutathionereductase (norm is 4.21 ± 0.14 mM/l) and reduced glutathione in erythrocytes (1.94 ± 0.04 mM/l).

The role of carbonic anhydrase is to facilitate balanced reaction:

$$CO_2 + H_2O \underset{\Leftrightarrow}{KA} H_2CO_3 .$$

If the concentration of CO_2 increases, the reaction shifts to the left, fat molecules are dehydrated, move closer to each other and do not let water-soluble substances pass through the membrane. Membrane polarization increases producing effect on quantitative indicators of SAS, HAS and thrombin-plasmin system.

Activation of SAS, HAS and thrombin-plasmin system is accompanied by changes in sodium and potassium molecules activation energy interconnected with the speed of reaction Δ r=Ead – Ear, where Ead – activation energy of direct reaction, Ear – activation energy of reverse reaction. These values are quantitatively related to thermal capacity and thermal conductivity.

Sodium-potassium-adenosinetriphosphatase regulates transmembrane ion interchange and is activated by potassium ions from the outer side of the membrane and by sodium ions from the inner side of the membrane. This enzyme requires magnesium ions as well and is repressed by calcium. We think that the mechanism which regulates the activity of sodium-potassium-adenosinetriphosphatase is related to phase substance transitions and to the process of H_2CO_3 saline formations where sodium and potassium ions are captured. In any case it would be logical to assume that reduction of membrane permeability caused by H_2CO_3 (carbonic acid) will resist transition of Ca from cavities of endoplasmic system (EPS) into cytoplasm where this substance could activate myosinic adenosinetriphosphatase and stimulate subsequent ion interchange. It is known that muscle relaxation is accompanied by return of Ca^{++} into EPS cavities and its dissolution from the protoplasm. Such return of Ca^{++} is accomplished in presence of adenosinetriphosphatase which activates the sodium-potassium-adenosinetriphosphatase and ion pumps thus ensuring cell repolarization which goes after its depolarization during excitation. This is confirmed by time parameters of QT interval according to electrocardiogram data and by quantitative indicators of plasmin. The above reactions are controlled by changing the concentration of H_2CO_3 at the membrane level. The concentration of H_2CO_3 depends on the cell metabolism level and is under control of primary stem respiratory centers.

The study of important neurochemical mechanisms in real time scale became possible from the moment when those processes were investigated with the use of hardware-and-

software package for noninvasive examination of regulatory homeostasis mechanisms. We determined the role of disorders of lactate-piruvate metabolism and the provocative role of lactate causing vegetative crisis for a number of patients, disorder of glutamate metabolism, insufficiency of dophamine brain systems, the role of hidden calcium insufficiency, the possible role of neuropeptide metabolism in connection with the behavior of temperature indicators in active points and condition of SAS, HAS and thrombin-plasmin system.

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