The Value Changes Redox System the Body Fluid Media for Life Processes and the Action of Drugs

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Abstract

The article presents information on the study of the possible effect of ionized liquids with different values of redox potential on the physiological processes and the action of drugs. To establish the possibility of changing the redox potential of body fluids in comparison with the arising physiological reactions and the action of drugs. A study involving 36 research volunteers who measured the redox potential and urine pH, ECG before and after 1.5 h after taking 3 ml / kg of the test liquid. Ionized fluid was administered to animals intraperitoneally or orally. On the culture of Paramecium caudatum studied changes in the speed of movement, resistance to environmental conditions, the time of 100% mortalities. When injected into a liquid with a negative redox potential, it is possible to reduce the redox potential of body fluids that does not cause changes in the state of the cardiovascular system, but has an anxiolytic effect on the Central nervous system. In the experiments in vitro found that drugs can change the value of the solvent redox potential. With the help of ionized liquids with different redox potential can change the redox potential of the body, which can lead to changes in the formation of the effects of drugs.

Introduction

The constant flow of energy required to maintain the active state of living matter is ensured in all living systems by electron transfer reactions from donors to acceptors. The greatest amount of energy can be obtained if the acceptor is oxygen, which eventually recovers to water, which is the main molecular component of all living systems and acts as a necessary catalyst for the recovery process [1]. In this case, free radicals can be formed - atoms or chemical compounds having an unpaired electron. These electrons attach to free radicals the properties of high reactivity and paramagnetic [3] and determine the bactericidal and cytotoxic effects of leukocytes, cell proliferation and the regulation of vascular tone [8], however, they can cause damage to almost all of the structural components of the biological system [2,4].

John. Pollack [9] called the properties of water adjacent to the hydrophilic areas: 1) this water is negatively charged (the potential reaches -150 mV) relative to the contacting volume of water; 2) when lighting its current increases, and there is a 4-fold increase in the thickness of the water layer; 3) protons are concentrated at the boundary between such water and volumetric water. Consequently, the body's water system is a system with charge separation, i.e. redox-a system that plays an important role not only in metabolic processes, but also the function of cells.

According to V. L. Voeykov [1], electrons of such water are excited more strongly than in ordinary water, i.e. it can act as a reducing agent and can serve as an almost inexhaustible source of electrons. Currently, the role of redox potential in the formation of pathological changes and in the modification of the effects of drugs is not clear, which justifies the purpose of the study: to establish the possibility of changes in the ORP of body fluids in comparison with the arising physiological reactions and the action of drugs.

Methods

All experimental procedures and protocols used in the work were carried out in accordance with the rules of laboratory practice, approved by the Guidelines on experimental studies and by the Order of the Ministry of Health and Social Development of Russia No. 708N of 23.08.2010 "On approval of the rules of laboratory practice" (GLP) [6] in compliance with the International recommendations of the European Convention on the protection of vertebrate animals used for experiments or other scientific purposes [ETSN 124, Strasbourg, 22.06.1998].The sacrifice of rats was carried out using an excessive dose of ether.

Some studies were conducted with the participation of 36 healthy research volunteers aged 20-21 years. Wherein the ethical norms set out in the Helsinki Declaration of 1964, modified by the 41st world Assembly (Hong Kong, 1989) and the 52nd General Assembly of the WMA (Edinburgh, Scotland (UK), October 2000, were observed. The Subjects signed informed consent and had the right to terminate their participation in the study at any time, regardless of the reason.

For the preparation of ionized liquids with different redox potential used water electrolyser «Karat-40», which has a certificate of conformity of the Ministry of Health of the Russian Federation № Ross RU AYA 60 B21242 №0021338. The value of ORP and pH of liquids was measured using a certified pH meter and ionometer «pH-150MI».

To determine the changes in the oxidation-reduction potential of body fluids in the introduction of liquids with different oxidation-reduction potential, a study was conducted with the participation of 36 volunteers, who measured the oxidation-reduction potential and urine pH, recorded ECG before and 1.5 hours after ingestion of 3ml/kg of the tested liquids: 1) with the oxidation-reduction potential -527 mV (L_n-liquid with negative oxidation-reduction potential).), 2) with a redox potential of +720 mV (L_p-liquid with a positive redox potential) and 3) redox potential is +230 mV (L_c-liquid source – control).

The ionized liquids were injected into the animals intraperitoneally once in the volume of 1 ml / 100 g of body weight or through by oral gavage in the same volume or for 4 weeks instead of drinking water with free access to the drinking bowl. In the control group, the animals were injected with water from which ionized liquids were prepared. Special in vitro experiments on synchronized culture of protozoa (Paramecium caudatum) were carried out to study the direct effect of liquids with different redox potential on living cells. Transfering of protozoa were made in test tubes from the calculation of 1.0 ml of culture Paramecium caudatum at 9.0 ml of the test environment. Control was carried out in 30 minutes, 1.5 hours, 3 hours and 24 hours after transfering of protozoa. From each test tube take 0.1 ml of liquid ciliates and filled her microaqueous. There had to be at least 100 cells in the microaquarium. The rate of movement of Paramecium caudatum induced by NaCl crystal based on the biological property of protozoa to negative chemotaxis was taken into account. The evaluation of the resistance of Paramecium caudatum to adverse environmental conditions was performed by the method of functional load: change of isotonic medium to hypertonic. Also we estimated time of occurrence of 100% mortalities.

In the study of the reactions of the cardiovascular system after changes in the redox potential of liquid media in laboratory animals recorded ECG on electrocardiograph «ECG 1T-03 M». Experiments on the isolated heart (48 hearts) carried out by the system in Langendorf perfused hearts of rats, equipped with software-hardware complex PhysExp production OOO «Kardioprotekt», Saint-Petersburg.

The state of the Central nervous system of animals when changing the redox potential of the internal environment of the body (60 rats) was studied at the facilities «Open field», «Rotating rod», muscular endurance on the treadmill (treadmill test), as well as tests «Conditional reaction of passive avoidance», «Extrapolation disposal»-these data are presented in a generalized form.

In the experimental study of regenerative abilities in the change of redox potential used 50 parent mature rats, both sexes weighing 230-250 g. Induction of pathology (surgical intervention for wounds) was carried out under ether anesthesia. The wound was applied on a template by means of a disposable scalpel in the middle of the cut part of the back to a length of 30±2 mm to its own fascia. Then, at an equal distance, 3 sutures (kapron thread) were applied to the edges of the wound. The test liquid was applied to the area of the wound within 7 days, once a day in a volume equal to 2 ml. Evaluation of the regenerative properties carried out on 1, 2, 3, 5 and 7 day of the study.

Digital data was processed on the basis of the recommendations Haphizanova R. H. [7] and methodical recommendations under the editorship of A. G. Kochetov [5], using parametric and nonparametric methods. Statistical processing of the obtained material and presentation of the results were performed using statistical analysis packages Microsoft Excel 2007 and SPSS 17.0 in the operating system Windows 7.

Results and Discussion

Changes in the redox potential of the body's liquid media with the introduction of liquids with different redox potential are presented in the table 1. It was found that the reception of ionized fluid with negative redox potential (L_n) was an increase in urine pH by 12% ($p<0.05$) and a decrease in the redox potential of urine by 35% ($p<0.05$). Other indicators have not changed. The pH, urine redox potential, SBP (systolic blood pressure), DBP (diastolic blood pressure), heart rate and other ECG parameters did not change in the groups of GP and after taking ionized liquids.

Table 1. Changes in urine pH and redox potential, blood pressure (SBP, DBP) and heart rate reductions (M±m, n=36) after taking liquids with different redox potential, healthy people

Indicator	L_n (redox potential is -527 mV)		L_p (redox potential is + 720 mV)		L_c (redox potential is + 230 mV)	
	Baseline value	90 minutes	Baseline value	90 minutes	Baseline value	90 minutes
Redox potential,	165.0±26.0	108.0±29.0*	126.0±17.0	120.0±40.0	132.0±25.0	115.0±27.0

mV. (urine)						
pH, urine	5.8±0.2	6.5±0.4*	6.3±0.6	6.5±0.6	5.9±0.4	6,2±0.6
SBP, mm Hg	113.0±11.0	111.0±10.0	121.0±8.0	119.0±10.0	119.0±9.0	118.0±10.0
DBP, mm Hg.	72.0±8.0	76.0±8.0	78.0±6.0	78.0±9.0	75.0±11.0	75.0±8.0
Heart rate reductions, BPM	73.0±5.0	72.0±5.0	78.0±8.0	78.0±7.0	84.0±7.0	84.0±7.0

* - p <0.05 - the differences are significant compared with baseline.

Consequently, the introduction into the ionized liquid with negative redox potential, it is possible to obtain a decrease in the value of redox potential of the body's liquid media. In this case, there is no change in the state of the cardiovascular system.

On the culture of Paramecium caudatum, the absence of biocidal and any negative effect on the protozoa under normal conditions and with an excess of sodium chloride of liquids with a negative oxidation-reduction potential from -180±50 mV to -500±50 mV was established. Moreover, there was an increase in the speed of movement of the simplest compared to the control, which gives us the right to consider this liquid nonspecifically increases resistance to changing and adverse environmental conditions. The maximum effect on the culture of Paramecium caudatum is provided by the medium with redox potential -180±50 mV, i.e. this value of redox potential is comfortable for the living cell.

Total forty-minute ischemia-reperfusion was simulated on the model of Langendorf-isolated rat heart. After it was made triphenyltetrazolium painted blue slices with thickness of 1 mm was counted and the area of necrosis of the myocardium. Perfusion was performed with Krebs-Henselate solutions with different redox potential. Experiments have shown that if liquid with negative redox potential was added to perfusate, the contractile activity of the heart decreased, but the zone of myocardial ischemia significantly decreased. On the ECG of rats, which were administered L_n, the amplitude of the wave R decreased (by 20-40%), and the magnitude of the amplitude of the wave P did not change. These data confirmed the previously known information about the increase of resistance of the organism to pathogenic factors with a decrease in the value of redox potential.

It is known that the brain is 80% water, the quality of which can determine its functioning. [17] The study of changes in the state of the Central nervous system in warm - blooded animals-rats (80) after the introduction of a liquid with a negative redox potential (-500mV) was carried out using the tests «Open field», muscular endurance on the treadmill (treadmill test), «Conditional reaction of passive avoidance», «Extrapolation disposal»-showed that the reduction of the redox potential of the body's liquid media is characterized by an anxiolytic effect, improving learning and memory, physical endurance.[15]

In experiments in vitro found that drugs can change the value of the redox potential of the solvent to varying degrees, depending on the chemical structure of the substance (table 2).

Table 2. The change in redox potential (% of baseline, n=160) of the fluid upon dissolution in it of drugs and their substances L_n (redox potential – 750 mV), L_p (redox potential +700 mV)

	Metamizole sodium		Chloramphenicol		Acidum acetylsalicylicum		Meloxicam		Methyluracil		Syntomycin		Lidocaine		Dioxidine	
Fluid	L_n	L_p	L_n	L_p	L_n	L_p	L_n	L_p	L_n	L_p	L_n	L_p	L_n	L_p	L_n	L_p
Drug	+140	-120	+80	-105	+120	-50	+100	-90	+95	-90	+95	-75	+130	-80	+100	-10
Substance	+10	-90	+20	-95	+90	+20	+100	-90	+60	-95	+80	-75	+80	-90	+90	-5

These data indicate the possibility of using pharmacological agents to change the redox potential of the body, which requires a more detailed study of these mechanisms in vivo.

The study of changes in the pharmacological effect on the example of the size of the pupil diameter of rabbit eyes (60) showed that the use of ionized liquid with negative redox potential together with 0.1% epinephrine hydrochloride solution has a prolonging

effect (pupil dilation) up to 20 minutes (300% - $p<0.05$), but the use of this liquid practically does not change the action of 0.1% atropine sulfate solution, and when studying the action of 1% pilocarpine hydrochloride solution-reduces the pharmacological effect (pupil narrowing) of the drug by 21% ($p<0.05$), hence the circular and radial muscle of the iris differently function when changing the oxidation-reduction potential. It can be assumed that there is a spatial disparity in the values of redox potential in a healthy body.[10]

The change in the function of a tissue is always accompanied by a change in the intensity of physiological regeneration processes. This can be most clearly seen on the example of the direct influence of liquids with different redox potential on pathologically altered tissues (table.3).

Table 3. The ratio of different types of scars (n=50) under local exposure to liquids with different redox potential

Type of scar	Group				
	Control (chlorhexidine)	L_p (redox potential is + 700 mV)	L_n (redox potential is -125 mV)	L_n (redox potential is -250 mV)	L_n (redox potential is -500 mV)
Normotrophic	60%	60%	80%	100%	80%
Hypertrophic	20%	40%	20%	-	20%
Keloid	20%	-	-	-	-

The most positive effect on the wound healing process when applied topically is observed in an ionized liquid with a negative redox potential (-250 mV). Consequently, the stimulating healing effect depends on the value of the redox potential.

Thus, with the help of ionized liquids with different redox potential, it is possible to change the redox potential of the organism, to correct on this basis its physiological reactions and shifts in the value of the redox potential caused by drugs.[13] Reducing the value of redox potential of the body fluids can lead to a change in the formation of the effects of drugs.

Conclusion

With the help of ionized liquids with different redox potential can change the redox potential of the body, which can lead to changes in the formation of the effects of drugs.

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