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SCENAR-therapy effect on the state of the blood plasma redox balance in patients with organ ischemic injury

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Ischemia and postischemic disorders will always be of current importance in medicine. A large group of diseases, where disturbed circulation or no circulation in the organ or tissue is one of the main pathogenic trigger, includes such severe diseases as acute myocardial infarction (AMI) and acute renal failure (ARF) caused compression injury [1,7].

Ischemia is the trigger element for a number of processes that inhibit the cell functionality at first stages thus helping them to survive in sudden oxygen deficiency. With the tissue reperfusion – restoration of the blood flow – cell injury may continue because of so called oxygen paradox caused by increased production of active oxygen forms and activation of lipid peroxidation (LOP) under these conditions. But reperfusion is the "necessary evil" [4]. The sooner it happens – the less permanent the damage is. In today's medicine mechanisms of reperfusion injury are called oxidative stress, which changes the redox balance (prooxidant – antioxidant balance) in the body and shows as accumulation of LOP toxic products and compensatory change in component activity of antioxidant system [1, 2, 5, 6].

Today many researches investigate the process of oxidative stress in patients with Q-wave AMI and ARF caused compression injury, when SCENAR-therapy is included into the multiple therapy [3, 8]. They prove that in comparison with other methods multiple therapy with SCENAR-therapy gives better clinical results due to arresting of the oxidative stress phenomena. We decided to continue investigations and find out is there any specific SCENAR-therapy effect on the oxidative stress in patients from the two groups.

Research objective
Investigate is there any specific SCENAR-therapy effect on the state of the blood plasma redox balance in patients with Q-wave AMI and ARF caused by compression injury.

Research task
Compare initial level and dynamics of primary, secondary and final LOP products in the blood plasma of patients with the indicated pathology: conjugated dienes (CD), malondialdehyde (MDA) and schiff bases (SB), as well as catalase (CA) and ceruloplasmin (CP) activity.

Materials and methods
Considering the research tasks and objectives we compared biochemical blood indices in both groups where patients were given standard treatment complemented with skin stimulation using SCENAR-97.4.
I group – 17 patients with ARF caused by compression injury.
The patients were treated using one of the two general stimulation methods: "3 pathways and 6 points" and "collar zone, forehead, adrenals" in the subjectively dosed mode (SDM). The treatment course started on patient's admission to the Acute Hemodialysis Department and included 10 daily sessions. The blood samples for biochemical tests were taken on admission and on the 1-2 day of diuresis recovery. It should be noted that average anuretic period in this group was 11.3±1.3 days.
II group – 30 patients with Q-wave AMI that had contradictions to thrombolytic therapy.
In these group patients were treated using one of the two general stimulation methods: "3 pathways and 6 points" and "collar zone, forehead, adrenals". Stimulation of the standard treatment zones was complemented with stimulation of heart zone (5-10 min) and pericardium meridian points (PC4, PC6 and PC7) on both arms (2-3 minutes). The treatment course included 10-14 daily sessions and started at the very first day of the disease. The blood samples were taken on admission and on the 16 day of treatment.

The quantity of conjugated dienes (CD) was determined spectrophotometrically using I.D. Stalnaya method (1977). The content of malonic dialdehyde (MDA) was measured by M.D. Stalnaya and T.D. Gorishvili method (1977). To determine Schiff Bases (SB), lipids were extracted from plasma using the Bligh-Dyer method (1959). Catalase activity (CA) in the blood plasma was determined using M.A. Korolyuk et al. method (1988). The oxidase activity of ceruloplasmin (CP) was determined using the Revin's method adapted by V.G.Kolba and V.S.Kamyshnikov (1982).

Indices of patients in both groups were compared with the indices of almost healthy donors-volunteers.

Results and discussion

The content of LOP products and activity of blood plasma enzymic antioxidants in patients with ARF caused by compression injury before and after multiple treatment complemented with SCENAR-therapy are given in the Table 1.

Table 1

Dynamics of LPO products and activity of blood plasma enzymic antioxidants in the patients from I group

Index	Donors, n =20	ARF patients, (n=17)	
		Before treatment	After treatment
Conjugated dienes, nmol/mL	13.69±1.08	20.54±2,71 (+50.0%) $p<0.05$	14.00±11.90 (+2,3%) $p>0.1$; $0.05<p_1<0.1$
Malonic dialdehyde, nmol/mL	27.97±2.16	40.58±2.13 (+45,1%) $p<0.01$	33.05±2.04 (+18.2%) $0.05<p<0.1$; $p_1<0.05$
Schiff bases, arbitrary unit/mL	1.41±0.06	1.88±0.10 (+33.3%) $p<0.01$	1.58±0.07 (+12.1%) $0.05<p<0.1$; $p_1<0.05$
Catalase, nmol H_2O_2/ mL	16.31±1.24	12.79±1.35 (-21.6%) $0.05<p<0.1$	16.05±1.25 (-1.6%) $p>0.1$; $0.05<p_1<0.1$
Ceruloplasmin, µmol/L	1.31±0.08	0.72±0.09 (-45.0%) $p<0.01$	1.08±0.09 (-17.6%) $0.05<P<0.1$; $p_1<0.05$

Note: p – significance of change as compared with donors;
p_1 – significance of change as compared with initial values;
numbers in parentheses show the percentage of the index change as compared with donors;

The table shows that on admission I group patients had essential disbalance in the redox balance of the blood plasma manifested as essential hypernorm of the CD, MDA and SB content by 50.0%, 45.1% and 33% respectively. Activity of blood plasma enzymic antioxidants was low: CA by 21%, CP by 45%. It should be noted that such a decrease in CA activity was not so significant ($0.05<p<0.1$), while in CP activity it was really significant.

As a result of multiple treatment complemented with SCENAR-therapy by the time diuresis recovered the correlation of free radical LOP intensity and AOS activity changed. Positive dynamics manifested as decrease of MDA, SB and CP activity if compared to the initial values was statistically true ($p_1<0.05$); decrease of CD and CA activity was almost true. Comparison of these indices with the conventional norm showed that CD and CA activity reached it, while MDA, SB and CP activity became closer to the conventional norm. In the very end CD, MDA and SB indices were 2.3%, 18.2% and 12.1% above norm respectively. CA activity changed not so significantly – it increased just by 1.6%, while CP activity increased significantly, but still was 17.6% below the norm.

The level of LPO products accumulation and activity of blood plasma antioxidants in patients with AMI before and after multiple treatment complemented with SCENAR-therapy are given in the Table 2.

Table 2

Dynamics of LPO products and activity of blood plasma enzymic antioxidants in the patients from I group

Index	Donors, n =36	ARF patients, n=30	
		Before treatment	After treatment
Conjugated dienes, nmol/mL	12.4 ± 1.7	29.6 ± 1.9 p<0.001 (+138.7%)	23.7 ± 1.8 (+91.1%) p<0.001; p_1< 0.05
Malonic dialdehyde, nmol/mL	20.9 ± 1.6	47.6 ± 1.7 p<0.001 (+127.8%)	44.4 ± 1.5 (+112.4%) p<0.001; p_1 > 0.1
Schiff bases, arbitrary unit/mL	1.06 ± 0.09	1.65 ± 0.13 p<0.001 (+55.7%)	1.09 ± 0.07 (+2.8%) p>0.1; p_1<0.005
Catalase, nmol H_2O_2/ mL	17.30 ± 1.37	14.50 ± 2.20 p>0.1 (-16.2%)	10.23 ± 1.04 (-40.9%) p<0.001; 0.05<p_1<0.1
Ceruloplasmin, µmol/L	1.08 ± 0.08	1.40 ± 0.11 p<0.05 (+29.6%)	1.41 ± 0.09 (+30.6%) p<0.05; p_1>0.1

Note: p – significance of change as compared with donors;
p_1 – significance of change as compared with initial values;
numbers in parentheses show the percentage of the index change as compared with donors;

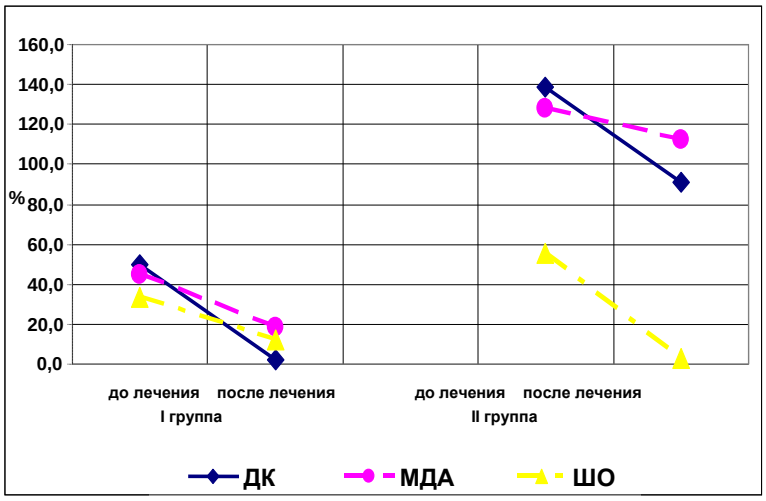
In II group patients the content of all LPO products before treatment was significantly (p<0.001) above the control values: CD - by 138.7%, MDA– by 127.8% and SF – by 55.7%. Moreover changes in antioxidant system functionality were detected. Blood samples before treatment showed that in patients' blood plasma CP oxidative activity increased by 29.6%, while dynamics of CA activity was not significant if compared to the control values.

Complementing standard therapy with SCENAR-therapy significantly helped to inhibit intensity of all LOP stages. That was showed as decrease of blood plasma molecular products. The CD level decreased significantly, but still was above the control values by 91.1%. The tendency of MDA dynamics was the same and after the treatment still was 112.4% above the control values. The most evident and intense effect of multiple therapy complemented with SCENAR-therapy was on toxic final LOP products, SB level by the end of the treatment course didn't significantly differ from the donor indices. High level of CP oxidative activity still remained by the end of the treatment course and was 30.6% above the conventional norm. CA activity during the treatment decreased by 40.9% if compared to the normal values, but if compared to the initial values only insignificant decrease was registered.

The indices of CD, MDA and SB in the blood plasma in patients with ARF caused compression injury and in patients with AMI before and after the treatment (percentagewise compared to conventional norm) are given in the **Diagram 1.**

Diagram 1

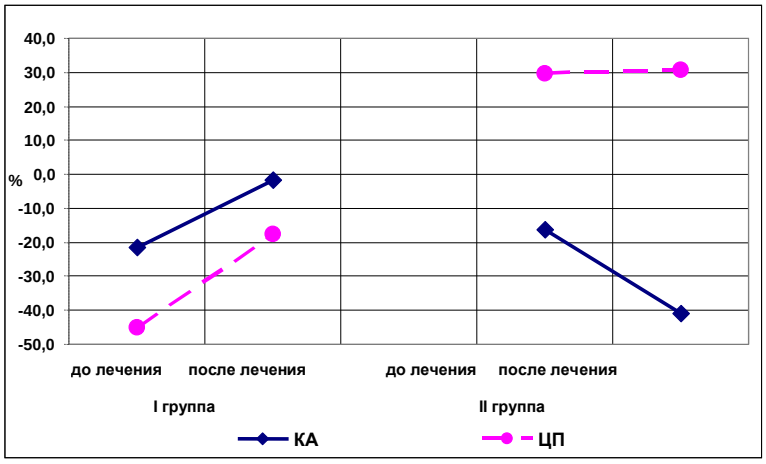
Dynamics of CD, MDA and SB indices in the blood plasma of both groups



The Diagram 1 shows that before the treatment LOP products of the testees were significantly high. The multiple therapy complemented with SCENAR-therapy caused decrease in the accumulation of primary, secondary and final LOP products.

Dynamics of activity of the blood plasma CA and CP in patients from both groups after the treatment (percentagewise compared to conventional norm) is given in the Diagram 2.

Diagram 2
Dynamics of CA and CP activity in the blood plasma of both groups



It was already stated above that catalase activity of the II group patients before the treatment didn't differ significantly from the conventional norm, only in ARF patients it tended to decrease. It should be noted that essential part of the catalase pool localizes in erythrocyte cytoplasm. In extracellular water it becomes inactive very soon. Increase of CA in the blood plasma can sign that it has released from the erythrocytes as a result of pathologically high membrane permeability or even their destruction [6]. Moreover, this index characterizes utilization rate of hydrogen peroxide in the blood plasma and its decrease during the treatment. That is registered in AMI patients and can be explained as result of generation decrease of active oxygen forms under the influence of the treatment. In the group with ARF patients no significant therapeutic effect on the catalyze activity was registered.

As against to CA, dynamics of CP activity differed significantly in the groups. In I group patients CP activity was 45% lower if compared to the donor values, and in the II group it was 29.6% higher. Such a difference in values can be explained by the period of time the disease

aroused. Let's make it clear. It is known that CP refers to proteins of acute phase and activity decrease in inflammation or after the injury, on one medical evidence by 2-3 times and on another by 30-60%, is considered as compensatory reaction directed to preserve plasma antioxidant potential and maintain copper and zinc metabolism at the optimal level [6]. This reaction was registered in patients with AMI at the very first days of the disease. In patients with compression injury ARF developed in some days after the injury, that's why by the moment SCENAR-therapy was included into the treatment and blood samples for biochemical indices were made oxidative stress was more intense and manifested in deterioration of plasma capacity, in particular in decrease of CP activity.

The diagram shows that the therapeutic effect on the CP activity in the groups was different. As a result of multiple therapy complemented with SCENAR-therapy in patients with ARF low activity of blood CP significantly increased, while in patients with AMI high activity of main plasma oxidant didn't change, i.e. compensatory activation of this antioxidant preserved, thus preserving antioxidant capacity of the blood plasma.

Findings

1. At the very first days of the disease patients with ischemic organ injury, in particular Q-wave myocardial infarction and acute renal failure caused by compression injury, have oxidative stress, which makes the redox balance of the blood plasma disordered.
2. Comparing the effect of multiple treatment complemented with SCENAR-therapy on the oxidative stress in patients from both groups we detected:
    - universal effect of inhibiting high activity of lipid perioxidation in blood plasma, which manifests as decrease in LOP molecular products accumulation.
    - regulating effect on the influence on the state of antioxidant system activity of blood plasma.