Original Article

Erythrocyte And Plasma Markers Of The Oxidative System In Children With Affective Respiratory Paroxysms

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Abstract

Affective-respiratory attacks were associated not only with iron deficiency anemia (IDA), but also with an imbalance of oxidants and antioxidants and damage to red blood cells caused by hypoxia. The present study was designed to study the contribution of the oxidative-antioxidant balance in children with ARP compared with healthy control groups. In addition, the study also aimed to determine the best predictive markers for oxidants and antioxidants.

Thus, the study of the role of the oxidative system in the development of ARP is an important scientific direction. The prospect of research should be a change in approaches to the prevention of progression, which can improve the effectiveness of care for patients with affective respiratory paroxysms.

Keywords: affective-respiratory attacks, children, antioxidant system, lipid peroxidation, melatonin.

Introduction

Affective-respiratory attacks (ARP) are periods in which children, after a provoking factor, especially anger, hold their breath during exhalation. They turn blue (cyanosis) and sometimes faint briefly. These periods last for several seconds over a minute. There are three types of ARP: cyanotic form, pale form and mixed form. The cyanotic form is the most common. The trigger is mainly anger. The pale form is caused by pain and is actually vasovagal syncope. Iron deficiency anemia is one cause of affective-respiratory paroxysms. Piracetam may have a beneficial effect on the frequency of ARP, but this drug is not indicated in the general prescribed practice. Some authors have shown that children with long QT syndrome are more likely to hold their breath, but this has not been confirmed in other studies. ARP can be an indicator of a broken parent-child relationship. Loss of consciousness is the result of a sharp decrease in cerebral blood flow and subsequent hypoxia caused by increased intrathoracic pressure and apnea.

The purpose of the trial is to prove the effectiveness of the method for diagnosing and treating ARP in children.

Research methods. In the clinic "REA-CENTER TASHKENT" for six months of 2022, 30 children with affective-respiratory paroxysm were admitted. In 60% of patients, the attack was cyanotic, 40% of patients were predominantly

pale and mixed. Affective-respiratory paroxysm is hard suffer by children, affects their mood, behavior, can negatively affect to the neuropsychic development of children, which has not only medical, but also social significance.

The examination was performed among 30 children aged 6 months to 3 years. The control group was formed from 10 practically healthy children of the same age. The final diagnosis of children from the main group was made on the basis of anamnesis, the results of an assessment of the neurological status and characteristics of seizures (debut, nature, course of seizures, the presence of provoking factors, discoloration of the skin), as well as laboratory methods of research (general clinical blood test and determination in blood serum biochemical markers (malonic dialdehyde (MDA) and diene conjugates (DC), superoxide dismutase (SOD), glutathione peroxidase, glutathione reductase, catalase, cytochrome-C and nitric oxide (NO)), and electroencephalography.

All studied patients were divided into 2 groups depending on the treatment: group 1 consisted of patients who received pathogenetic therapy, which included nootropic drugs (noofen), iron-containing drugs (fersinol, maltofer) and melatonin; Group 2 patients received only conventional therapy. At the first stage, anamnestic data were analyzed, the perinatal period, the neonatal period; assessment of biological and social factors;

At the second stage, was conducted a clinical and neurological examination, taking into account neuroimaging and neurophysiological methods of examination;

At the third stage, the results of biochemical studies were evaluated by spectrophotometry before and after the therapy.

All patients underwent biochemical studies. In order to determine the effectiveness of the therapy, the levels of proteins, malondialdehyde (MDA) and diene conjugates (DC), superoxide dismutase (SOD), glutathione peroxidase, glutathione reductase, catalase, cytochrome C, and nitric oxide (NO) of erythrocytes were measured.

The obtained data were subjected to statistical processing on a Pentium-4 personal computer using programs developed in the EXCEL package, using a library of statistical functions, with the calculation of the arithmetic mean (M), standard deviation (σ), standard error (m), relative values (frequency, %), Student's test (t), with the calculation of the error probability (P).

Differences in mean values were considered significant at a significance level of $P<0.05$. At the same time, the existing guidelines for statistical processing of the results of clinical and laboratory studies were followed (Zaitsev V. M. et al., 2003).

Study results. In children with ARP, when treated with melatonin and iron-containing preparation, compared with the period before treatment, the indicators of the AOS system increased, and nitric oxide decreased to a normal level. We have witnessed that melatonin can serve as a broad-spectrum antioxidant. The addition of melatonin resulted in an increase in the activity of antioxidant enzymes such as total superoxide dismutase, glutathione peroxidase, glutathione reductase, and catalase. Children who received standard treatment had a less significant increase in the concentration of the marker (Figure 1).

Figure 1 Comparative indicators of erythrocyte markers in children ARP before and after treatment.

Analyzed indicators antioxidant system	**Statistical indicators**	**Control group**	**ARP before treatment**	**ARP after treatment 1 group**	**ARP after treatment 2 group**
superoxide dismutase units./mg protein	M±m	12.08±0.09	8.96±0.23	11.98±0.21*	8.75±0.74
glutathione peroxidase mM/min g protein	M±m	2.81±0.01	1.76±0.01	2.17±1.8*	1.99±0.12
catalase mkat/mg protein	M±m	41.09±0.9	37.48±1.72	40.98±0.08*	34.11±1.1
glutathione reductase mM/min g protein	M±m	1.65±0.09	1.35±0.04	1.56±1.6*	1.39±2.8
nitrogen oxide μmol/l	M±m	29.02 ± 0.23	69.03 ± 5.03	32.02 ± 0.07*	56.15 ± 5.2
glutathione transferase mM/min g protein	M±m	3,91±0.08	2.44±0.1	3,80±0.21*	2.07±0.91

cytochrome C-oxidase µmol/mg protein	M±m	1.56±0.21	1.35±0.08	1.57±1.2*	1.08±0.11

*p<0.05 - significance compared to the period before treatment.

This process is accompanied by a decrease in oxidation in the respiratory chain, eventually leading to a decrease in the total level of peroxidation and malonaldehyde.

When studying the parameters of lipid peroxidation in blood plasma in the development of affective-respiratory paroxysms, it was found that the levels of DC and MDA were increased in all forms of ARP before treatment. When assessing changes in the concentration of lipid peroxidation in the blood serum under various treatment regimens, it was determined that the concentration of DC and MDA significantly decreased after treatment with a pathogenetic approach to therapy. (Figure 2).

Figure 2. LPO indicators in blood plasma in children ARP before and after treatment.

Analyzed groups of children	**Analyzed LPO indicators (mmol/ml)**	
	MDA	**DC**
Control group	2.54±0.12	1.45±0.08
ARP before treatment	3.75±0.13	2.04±0.13
ARP after treatment Scheme A	2.68±0.09*	1.49±0.45*
ARP after treatment Scheme B	3.55±0.23	1.88±0.13

*p<0.05 - significance compared to the period before treatment.

Our data indicate that the magnitude of oxidative stress was significantly higher in patients with ARP than in controls. Conditions associated with increased oxidative stress may be a risk factor for the development of epileptic seizures.

The results of the study showed that the oxidant-antioxidant balance in children with ARP is disturbed in favor of oxidants, regardless of the severity of ARP attacks. In addition, LPO and AOS were found to be the biomarkers that show the greatest likelihood of experiencing sleep apnea.

Conclusion:

1. During the planned study, plasma and erythrocyte markers of oxidative stress in the development of affective-respiratory paroxysms were studied. Changes in these parameters correlated significantly with the overall antioxidant capacity of plasma. Conditions associated with increased oxidative stress may be a risk factor for the development of convulsive readiness and may be an additional diagnostic criterion and have prognostic significance.

2. The state of lipid peroxidation processes and antioxidant defense systems may play a role in the pathophysiology of ARP attacks. Our data indicate that the magnitude of oxidative stress was significantly higher in children with ARP than in the control.

3. The inclusion of melatonin in the complex of treatment as an antioxidant drug, helps to join the system of protecting the brain from oxidative stress, selectively prevents free radical processes, has an antioxidant effect and it is an alternative to anticonvulsant therapy for non-epileptic paroxysms.

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