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## SECONDARY PATHOGENETIC MECHANISMS OF NEURAL TISSUE DAMAGE IN BRAIN CONCUSSION

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### ABSTRACT

The state of pro- and antioxidant systems in patients with brain concussion has been studied. The definite patterns of the functioning of these systems in this pathology have been disclosed.

Key words: brain concussion, pathogenesis, antioxidant systems.

**Introduction.** Mild traumatic brain injury (TBI) is one of the most common types of nervous system lesions. Nearly 80% of all mild TBI cases are presented by brain concussion [1]. Despite the term "mild" this type of trauma is characterized by high frequency of posttraumatic complications. The cause of it should be found in peculiarities of acute period of TBI when a cascade of irreversible changes in neural tissue is formed [2].

It has been proved that activation of lipid peroxidation and biopolymers is an early universal and extremely sensitive marker of injury. It is characteristic of various pathological conditions including traumatic lesions of nervous system. The complexity of this problem is determined by favorable conditions for the progression of free radical pathology in central nervous system that include high lipid content (optimal substrate for lipid peroxidation), maximum oxygen consumption, well developed system of biological membranes. These facts stipulate particular susceptibility of brain for oxidative injury of cerebral structures [3]. Given the above we considered it appropriate to assess the extent and dynamics of pro- and antioxidant imbalance in

patients with brain concussion.

**Materials and methods.** We have examined 52 patients with brain concussion aged 18-40 years and the control group which comprised 15 practically healthy individuals comparable by age and sex. Brain concussion was diagnosed based on neurological and instrumental examination. Biochemical studies were done in plasma and erythrocytes of patients and donors. Blood sampling was performed in the morning on an empty stomach on the first, third and fifth day after traumatic injury. It included malonic aldehyde, ceruloplasmin, medium weight molecules, glutathione, HS-groups, catalase activity.

**Results and discussion.** The degree of activation of free radical processes was assessed by content of malonic aldehyde which is one of the final products of lipid peroxidation. On the first day the level of malonic aldehyde was practically equal to normal ranges. However on the third day and especially on the fifth day we have observed noticeable increase of plasma level of malonic aldehyde by 38.6% (Table 1).

Table 1

The dynamics of pro- and antioxidant systems indexes in patients with brain concussion

	1 <sup>st</sup> day	3 <sup>rd</sup> day	5 <sup>th</sup> day	Control
Malonic aldehyde, $\mu\text{mol/L}$	14.8 $\pm$ 0.72*	15.2 $\pm$ 0.80*	17.3 $\pm$ 1.23**	12.5 $\pm$ 0.86
Ceruloplasmin, mg/L	246.2 $\pm$ 4.61**	317.8 $\pm$ 5.54***	218.3 $\pm$ 6.42	227.4 $\pm$ 3.65
Catalase activity, $\mu\text{mol/min L}$	96.4 $\pm$ 2.64	91.8 $\pm$ 4.73	83.6 $\pm$ 3.51	86.9 $\pm$ 4.57
Glutathione	0.33 $\pm$ 0.021	0.18 $\pm$ 0.024	0.15 $\pm$ 0.013*	0.26 $\pm$ 0.044
Medium weight molecules, U/ml	0.32 $\pm$ 0.025	0.36 $\pm$ 0.036*	0.37 $\pm$ 0.034**	0.26 $\pm$ 0.023
SH-groups, $\mu\text{mol/ml}$	1.7 $\pm$ 0.08	1.4 $\pm$ 0.06*	1.4 $\pm$ 0.05**	1.7 $\pm$ 0.04

Significance of differences in comparison with control group (p): \* - p<0.05; \*\* - p<0.01; \*\*\* - p<0.001.

In the blood samples of all patients on the first day there was an increase of activity of catalase which is an enzyme of first line of defense. Catalase is one of the basic enzymes of antioxidant protection and elevation of its activity on the first day after TBI points at activation of lipid peroxidation in patients with concussion. Assessment of dynamic changes has shown gradual decrease of catalase activity which gives evidence of debilitation of proper antioxidant protection.

On the first day in patients with concussion there was

insignificant elevation of glutathione as the basic component of protective glutathione system in comparison to the results of control group. However on the third day we observed sharp decline of glutathione level in compared to the original data. The component of glutathione is sulphhydryl (SH) group which plays important role in normal functioning of membrane structures. On the first day after trauma there was mild elevation of SH-groups level but then it was followed by decrease of their level.

In all patients with brain concussion on the first day

after trauma we found increase of ceruloplasmin activity as manifestation of defense response. By the third day this level increases almost by 40% in comparison to control group, but then it significantly decreases. It has been proved that ceruloplasmin is the basic antioxidant of blood plasma both in normal and in pathology which prevents and inhibits lipid peroxidation by oxidation of bivalent iron. Antioxidant effect of ceruloplasmin depends on its ferroxidase activity. We can assume that ceruloplasmin takes part in destruction of toxic free radicals of superoxide anion which is a product of aerobic metabolism.

On the first day we found significant increase of medium weight molecules. Moreover in 87% of patients there was an increase of their level within five days. Medium weight molecules are one of the objective markers of metabolic intoxication [4]. Increase of their level on the first day and in early posttraumatic period indicates that brain concussion is characterized with progressive-metabolic disorders.

So we can make a conclusion that mobilization of protective antioxidant mechanisms in the brain softens primary activation of lipid peroxidation. However it is followed by their further exhaustion that leads to destructive changes of nervous cells. That is why early determination, prevention and correction of secondary brain injury largely determine the results of treatment.

Conclusions. 1. In patients with brain concussion activation of free radical oxidation is most pronounced in five days after traumatic brain injury.

2. On the first day of trauma there is expressed activation of protective antioxidant factors (increased activity of catalase, content of ceruloplasmin, SH-groups, glutathione). The dynamic observation has shown gradual decrease of antioxidant activity.

3. The most noticeable changes were shown in the level of medium weight molecules that may be considered as a sensitive criterion of metabolic intoxication in patients with brain concussion.

Attention is drawn to the need of the further study of biochemical processes that lead to irreversible changes in nervous tissue, as well as development and implementation of the drugs for correction of energetic metabolism and protection against secondary destruction of the cells.

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## ASSESSMENT RESULT OF CATARACT STAGES DISTRIBUTION AND CONCOMITANT DISEASES STRUCTURE

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#### ABSTRACT

The results of assessment of cataract stages distribution are provided. The research was carried out using case histories of 14911 patients (10409 men and 14502 women), who was operated during 2006-2011. It was shown that maximal number of patients with cataract of all stages is in age group of 71-80 years old and in average the same number is in age groups of 61-70 and in older than 80 years. Moreover, distribution of patients in accordance with cataract stages between gender groups has authentically no difference. In both gender groups 93% of patients had immature (53%) and mature (40%) cataract.

Based on the analysis of concomitant morbidity of 540 cataract patients it had been determined that more frequently met concomitant pathology was hypertensive disease ((34,6±2,1)% of tested) and coronary heart disease ((28,9±2,0)% of tested). Pancreatic diabetics were common for (12,8±1,5)% of cataract patients, moreover it was more frequently found among patients of young age, myopia alta, glaucoma and joint diseases was found only among 6-8% of tested patients.

Key words: cataract, cataract stages, glaucoma, myopia, pancreatic diabetics, hypertensive disease, coronary artery disease.

Formulation of the problem. According to modern data cataract is the reason of blindness of over 18 millions of people from different countries all around the world. Over the past few years in many countries a number of cataract patients grew significantly, this happened as a result of population ageing. Not looking at substantial progress of cataract surgery, a more considerable increase of morbidity rate is expected in near future. The number of blind because of cataract is predicted to be 40 millions of people until 2025. It was determined that

over 60 % of operations which carried out in ophthalmological establishments had been performed for cataract treatment [2,7].

Recent statistic shows that more than three millions of citizens' requests for medical help because of eye diseases registered in Ukraine each year. In the structure of eye morbidity in the past 10 years cataract takes the second place (11%) after conjunctive diseases (30,7%) [7,10].

Analysis of latest publications. Cataract is currently