Metabolic abnormalities of erythrocytes as a risk factor for Alzheimer's disease

Kosenko E.A.

Tikhonova L.A.

Montoliu C.

Barreto G.E.

Aliev G.

Kaminsky Y.G.

Alzheimer's disease (AD) is a slowly progressive, neurodegenerative disorder of uncertain etiology. According to the amyloid cascade hypothesis, accumulation of non-soluble amyloid ? peptides (A?) in the Central Nervous System (CNS) is the primary cause initiating a pathogenic cascade leading to the complex multilayered pathology and clinical manifestation of the disease. It is, therefore, not surprising that the search for mechanisms underlying cognitive changes observed in AD has focused exclusively on the brain and A?-inducing synaptic and dendritic loss, oxidative stress, and neuronal death. However, since A? depositions were found in normal non-demented elderly people and in many other pathological conditions, the amyloid cascade hypothesis was modified to claim that intraneuronal accumulation of soluble A? oligomers, rather than monomer or insoluble amyloid fibrils, is the first step of a fatal cascade in AD. Since a characteristic reduction of cerebral perfusion and energy metabolism occurs in patients with AD it is suggested that capillary distortions commonly found in AD brain elicit hemodynamic changes that alter the delivery and transport of essential nutrients, particularly glucose and oxygen to neuronal and glial cells. Another important factor in tissue oxygenation is the ability of erythrocytes (red blood cells, RBC) to transport and deliver oxygen to tissues, which are first of all dependent on the RBC antioxidant and energy metabolism, which finally regulates the oxygen affinity of hemoglobin. In the present review, we consider the possibility that metabolic and antioxidant defense alterations in the circulating erythrocyte population can influence oxygen delivery to the brain, and that these changes might be a primary mechanism triggering the glucose metabolism disturbance resulting in neurobiological changes observed in the

AD brain, possibly related to impaired cognitive function. We also discuss the possibility of using erythrocyte biochemical aberrations as potential tools that will help identify a risk factor for AD.

Alzheimer's disease

Amyloid ?

Clinical manifestation

Erythrocytes

Metabolic dysfunction

Multilayered pathology

amyloid beta protein

glucose

glutamic acid

Alzheimer disease

cell damage

cognitive defect

erythrocyte

erythrocyte transfusion

glucose metabolism

human

metabolic disorder

nonhuman

oxygen transport

Review

risk factor

vascular amyloidosis