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Mini Review

The Roles of Ascorbic Acid in the Nervous System

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Abstract

However different aspect of vitamin c's affect is not cleared till now, but it is proved that Vitamin C plays several key roles in our body specially during early postnatal period and in natural developing brain specially hippocampus and spatial memory neurons . It must be noticed that it's deficiency also effects memory involved neurons in early life. Some other researches [1] show that Vitamin C regulates transcription of many vital proteins such as collagen notably in sciatic nerves which prevents some sensorimotor disorders.

Keywords: Vitamin C; Nervous system; Ascorbic acid

Abbreviations: DHA: Dehydroascorbic Acid; AA: Ascorbic Acid; SNS: Sympathetic Nervous System; PTZ: Pentylenetetrazol; CA_3: Cornu Ammonis 3; BH_4: Tetrahydrobiopterin; BH2: Dihydrobiopterin; CA_1: Cornu Ammonis 1; A_3R: A_3 Receptors; ROS: Reactive Oxygen Species; SVCT: Sodium±Vitamin C Co-Transporters; AD: Alzheimer Disease; VDR: Vitamin D Receptor

Vitamin C and Nervous System

Vitamin C (vit C) in body transports by 2 mechanisms: 1) Efficient transport of dehydroascorbic acid (DHA) through glucose transporters. 2) Sodium-dependent co-transport of ascorbic acid (AA) [2]. Vitamin C plays many roles in our body. It increases neurogenesis and can be helpful in prenatal noise stress condition. Prenatal stress increases free radicals [3]. As Vit C is an electron donor, it can protect neurons from free radicals [1,2]. Oxidative stress influence the sympathetic hyperactivity characterizing essential hypertension and contributes to the development of hypertension through activation of the Sympathetic Nervous System (SNS). Vit C also modulates the effects of ethanol and PTZ, which reduce BCL2 protein expression and increase bax and cytochrome c levels and caspase-9 protein and caspase-3 protein (due to increased cytochrome C level) expression, thereby increasing apoptosis is occurred [4]. This condition decreases the number of neurons in all subdivisions of hippocampus . Therefore, the number of axons in CA3 area that is efficient in spatial

memory is reduced. This means Vit C deficiency in early postnatal life impairs spatial memory. It seems that Vit C deficiency in high-risk individuals is harmful for natural developing of brain [5]. Vit C deficiency decreases tetrahydrobiopterin (BH_4) and increases dihydrobiopterin (BH_2)/BH_4 in plasma, but Vit C deficiency has shown no changes in morphology of pyramidal neurons in Cornu Ammonis 1 (CA_1) area of hippocamp [6]. Activation of A_3R, not A_1R and A_2AR, activates adenosine receptor and can modulate ascorbate transportation by increasing its diffusion, so intracellular ascorbate will decrease and Reactive Oxygen Species (ROS) will be accumulated in cells [7]. A_3R activation also alters the oxidation balance through $SVCT_2$ without any change in the production or consumption of ATP neurons [6]. Morphometry significantly reduced myelin thickness but unaffected axon diameters and hydroxyproline levels are unchanged. Collagen transcription is regulated by ascorbic acid in sciatic nerves. the results show that a decrease in the concentration of AA, hypomyelination and a defect in collagen leads to sensorimotor disorders [8].

Vit D protects the brain against the adverse effects Alzheimer Disease (AD). Behavioural effects of adult vit D deficiency are not associated with proliferation or survival of neurons in the adult hippocampus [9]. But Administration of high doses of Vit D without knowing its serum level can cause Hypovitaminosis D and neurological complications. The difference is in the expression of polymorphic variants of VDR gene. Cooperating between astrocyte & neuron make vitamin c being recycled while AA plays a pivotal role in defensing which is not used so much by tumor cell contrariwise hippocampus [10]. Healthy people have the ability to modulate sympathetic- mediated peripheral vascular resistance through endothelial synthesis of nitric oxide despite the people who have CHF [11]. The key rule of Vitamin C in protection of DNA, proteins and lipids from oxidative damage [12] Based on some assays it's found that vitamin C has effects on the sensorimotor [13]. It's examined and cleared that Vitamin C by presenting anti-inflammatory mechanism down-regulates the levels of pro-inflammatory mediators [14] Antioxidants such as Vitamin C and N-Acetyl-L- cysteine play a key role in deface damages which are caused by treatment of ethanol [15].

deficiency could be an effective factor which cause embryonic midbrain deficiency of VC and later reduced midbrain-type dopamine [16]. VC deficiency in brain with redox imbalance together impose negative effects on neuronal morphology [17].

Conclusion

In this paper we have studied on the Vit C transportation, its effect in hypertension and some proteins expression and its deficiency affects on human body. We understood that accumulation of reactive oxygen species could be occurred in cell during diffusion of Vitamin C. Vitamin C prevents hypertension and sensorimotor disorders; Vitamin C also could regulates apoptosis by having effect on protein transcription. Its deficiency also attracted our attention that could be so harmful for natural brain developing in high-risk groups specially in postnatal period. During our study about the vitamin c roles in CNS, Vitamin D protects the brain against the adverse effects Alzheimer Disease; however must pay attention to its consumption dose in order to prevent Hypovitaminosis.

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