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Book Review

Vitamin C in human health and disease

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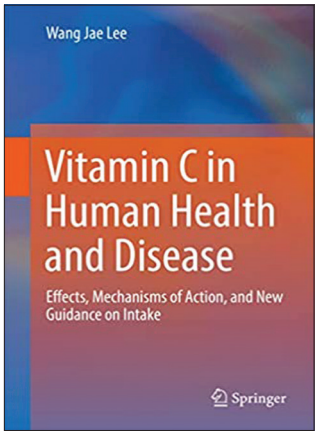

Author	:	Wang Jae Lee
Hardcover	:	2019
Springer	:	Springer Nature B.V, Van Godewijck Straat 30, 3311 GX Dordrecht, The Netherlands
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For many of the readers, the title of this book may seem slightly inappropriate for a Neurosurgery Journal, but when I go through it and briefly review the related topics, it will show the importance of the role this vitamin has in the function of different organs of the human body, especially the central nervous system (CNS).

Dr. Wang Jae Lee from the Department of Anatomy in Seoul National University College of Medicine has done a comprehensive review on the role of Vitamin C in human body.

It starts with a very fascinating introduction of the history of how this vitamin was discovered by a disease symptom that we currently call scurvy, which goes back to 1550 BC written down on papyruses and later on 400 BC described by the Father of Modern Medicine Hippocrates as a combination of fetid breath, lax gums, and bleeding from the nose.

There are many prominent physicians and chemists who contributed enormously to the discovery of this vitamin.

In 1928 AD, a Hungarian Biochemist named Albert Szent-Gyorggi isolated an organic reducing substance, hexuronic acid from adrenal glands of animals and later on named it ascorbic acid. Eventually in 1937 AD, he was nominated as Laurate of Noble Prize in Medicine for his discovery of what we call it Vitamin C today.

After the introduction, Lee reviews the effect of Vitamin C on different organs of the body

including cardiovascular, immune system, G.I., liver, CNS, skin, and eye.

I will summarize only the effect on cardiovascular system (CVS) and CNS.

To be noted that Vitamin C is normally produced in the bodies of mammals except primates including humans. This is because of the gene encoding the oxidase is muted in primates resulting in failure of Vitamin C production.

It has been known that Vitamin C is an essential cofactor for collagen synthesis which helps wound healing.

In regard to CVS, Vitamin C can prevent low-density lipoprotein (LDL), (the bad cholesterol) peroxidation by reactive oxygen species (ROS), which is an important prerequisite for the formation of atherosclerotic vascular lesions, and it can induce endothelial damage to the arteries.

Regarding ROS, to be noted that it is generated during normal physiological processes for maintaining life. It is known that ROS can induce chronic endothelial damage over one's life excluding other factors, for example, smoking and diabetes, which both could add to more deleterious damage to the vessel walls.

Vitamin C can also regenerate oxidized Vitamin E by reducing it back to its original form which is a stronger antioxidant than Vitamin C.

Vitamin E has been reported to slow the rate of LDL oxidation also.

By saying so, the effect of Vitamin C on CVS, we may assume that Vitamin C can also be an important factor for prevention and alleviation of intracranial atherosclerotic disease which is more prevalent in certain ethnicity and has been explained in the past 10–20 years by interventional radiologists and neurologists.

In addition, Vitamin C could have preventive measure in certain cases of intracerebral hemorrhage by protecting the vessel walls in conjunction with blood pressure control.

In regard to the effect of Vitamin C on CNS, Lee starts by explaining the four types of capillaries found in human body and then explains the blood brain barrier (BBB). The capillaries which are found in CNS have continuous cell lining which he called type 1, rather than being fenestrated.

These capillaries have tight junction between the endothelial cells and pericytes in their wall.

He describes the transfer of Vitamin C to CNS in a very clear diagram on page 103 of his book.

The diagram demonstrates the mechanism of transfer of Vitamin C from blood through choroid plexus through sodium-dependent Vitamin C transporter (SVCT2) to cerebrospinal fluid (CSF) which is BBB. Furthermore, he describes how the oxidizing form of Vitamin C, dehydroascorbate (DHA) passes through glucose transporter (GLUT) from blood to CSF. From CSF, Vitamin C (L-ascorbate) enters the neurons through SVCT2, while DHA enters the neurons through GLUT on neuron's membrane and then is converted to ascorbate.

On astrocyte's membrane, only DHA enters the cell through SVT2 and is converted to ascorbate.

The usual Vitamin C concentration in human peripheral blood ranges from 11 to 90 micromole.

People whose plasma concentration is less that 11 micromole are called scurvy patients.

However, the concentration of Vitamin C in neuronal cytoplasm is approximately 10 m-mole, about 200 times as high as the human serum concentration. In addition, the cytoplasmic concentration of Vitamin C in astrocytes or microglia cells, which consume 20% of the total amount of oxygen neurons use is about 1~2 m-mole.

This signifies the importance of the role of Vitamin C in the function of the CNS.

I hope by reading this book, the people in our field and the related specialties will recognize the important role of this vitamin in the function of human body.

Finally, it reminds me of my Mentor, the late Professor Jean Pierre Caron, Head of the Neurosurgery at Henri Mondor Hospital in Paris who used to add Vitamin C and some other vitamins in the IV fluids of the critically injured neurosurgery patients for their recovery.

This is suggestive of the wisdom and experience of old well-trained academic neurosurgeons in caring of their critically ill patients.

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