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CORRESPONDENCE

Chronic Diseases and Translational Medicine

Vitamin D and hypertension: Is there any significant relation?

Dear Editor,

Around a billion individuals worldwide have hypertension. Of these, 95% have essential hypertension, a type of undiagnosed hypertension.[1] The regulation of blood pressure (BP) involves numerous signaling pathways. Among them, the Renin Angiotensin System is well known. All these pathways are regulated by modulation of renal salt handling and tone of vascular smooth muscle (VSM) tissue. Any of these mechanisms can become faulty and alter the resistance arteries' VSM tone, which can elevate BP. However, since the exact origin of PH and its pathophysiology are unknown, less effective, and generic treatments are used.[2] The fact that more than 50% of hypertension patients in the USA do not have their BP under good control serves as an illustration of this. Antihypertensive treatment resistance affects an additional 5 million people and is defined as the inability to regulate BP despite the use of at least three antihypertensive drugs in combination.[3]

Increasing age, racial variables, history in household members, obese status, physical inactivity, larger amounts of salt consumption, stress, tobacco use, and heavy alcohol use are some of the potential etiological factors for essential hypertension.[4] It has been examined in previous meta-analyses how vitamin D supplementation affects BP,[5] but it is still unclear whether this connection is causal in the general population. This study focused on finding out the effect of vitamin D3 deficiency on BP.

Vitamin D, a steroid hormone, promotes the calcium and phosphate absorption from the gastro-intestinal tract (GIT) and reabsorption from the renal tubules. At low levels, it causes bone mineralization. At high doses, it causes bone resorption. It contributes significantly to mineral metabolism and skeletal homeostasis in this way.[3]

Up to 80% of human vitamin D comes from vitamin D3, which is produced in the skin by ultraviolet (UV) radiation from 7-dehydrocholesterol. Fish, egg yolk, fortified milk, cereal, juice, and yogurt are dietary sources of vitamin D that provide D2 as well as D3 forms and account for around 20% of the body's requirement. The significant vitamin D form, 25-hydroxyvitamin D [25(OH)D], is produced by the liver from D2 and D3 forms of vitamin D in the body. It is the most accurate measure of the action status and levels of vitamin D. It mostly depends on the serum vitamin D binding protein.[4]

According to the Institution of Endocrinology clinical practice guidelines, blood 25-hydroxyvitamin D [25(OH)D] results below 20 ng/mL (or 50 nmol/L) are considered deficient levels of vitamin D. Inadequate vitamin D status is ubiquitous among Chinese.[4] Numerous studies have been published describing how vitamin D deficiency can lead to cancer,[6–10] metabolic disorders, and cardiovascular disease. It has been shown to be negatively correlated with risk. It has been hypothesized that fluctuations in BP may be related to vitamin D administration among individuals with deficient levels of vitamin D.[11] Regular vitamin D provision can lower levels of blood-pressure in patients with low levels of vitamin D, without the need for high doses of medication. It may be a simple cure for what can become a chronic condition.[12]

Every 10% rise in 25-hydroxyvitamin D concentration was found to result in an 8.1% reduction in the risk of hypertension.[13] Researchers are considering further research into how Vitamin D deficiency may affect other risk factors for heart disease, such as the likelihood of Type 2 diabetes and high cholesterol, after discovering this potentially significant association.

To date, over several randomized clinical trials have been organized by researchers to determine whether vitamin D administration lowers BP and determine its role as a prevention strategy.[14–16] The results of these studies are mixed, as they demonstrate an unsatisfactory design, and the mechanisms underlying how vitamin D affects hypertension remain to be deciphered. Therefore, many meta-analytical studies have attempted to integrate previous results and thereby assess the functional relation of vitamin D administration in regulating BP.[4]

A meta analysis published earlier by Zhang et al.[15] has found that the risk of hypertension was significantly increased when 25(OH)D was reduced below 75 nmol/L, but continued to be prominent in the 75–130 nmol/L range. BP is approximately L-shaped (nonlinearity = 0.04). However, aggregated data showed that neither systolic nor

diastolic BP was significantly reduced after the vitamin D intervention.

Primary hypertension is caused by many factors that interact with aging by means of hereditary and ecological determinants. Although vitamin D deficit promotes increased vascular tone,[16] it may not be a significant environmental factor in regulating normal BP homeostasis, but it does impair the causation of primary HTN among susceptible adult individuals, which works as a catalyst.[16,17] Other noteworthy hypotheses have indicated that vitamin D alters vascular endothelial function or VSM intracellular calcium concentrations. This is the most notable mechanism linking vitamin D to hypertension.[18] The enhanced renin-angiotensin-aldosterone system (RAAS) activity and improvement in hypertension observed in studies with vitamin D receptor (VDR) knockout mice point to a critical role for vitamin D as a potential antihypertensive medication.[19]

Studies conducted previously have been shown to bring inconsistent results. The information presented in this context gives a conclusion accordingly in a cohort of vitamin D-deficient hypertensive patients, moderately high doses containing vitamin D will either restore or close to physiological blood 25(OH)D levels and prominently decrease BP. Surprisingly, some studies failed to observe an improving effect of vitamin D on BP. However, the contradicting results may be due to poor research methods, confounding role of other anti-hypertensive agents, and <10 cohorts. Forty percent of people have vitamin D deficiency along with having either extremely low or increased levels of intaking vitamin D. In normotensive subjects with or without vitamin D, there was little effect on BP.[17]

However, from a 5-year VITAL experiment, supplementing a cohort of people at ages likely to develop vitamin D deficiency levels with high regular amounts of intake of vitamin D reduced hypertension, which may be circumvented. This VITAL study has also found a reduction in cancer-related risks, apart from reducing hypertension.[12]

Advances in clinical research coupled with detailed mechanistic studies may pave the way for large-scale clinical trials conducted in specific demographic groups. The public health burden of managing PH is reduced when vitamin D supplements are administered to the population, reducing the public health burden and helping to dramatically improve clinical practice of PH interventions. Physicians are also encouraged to check their patients' vitamin D levels to help control increasingly frequent high BP.

AUTHOR CONTRIBUTIONS

Naga P. Vakkalagadda: Conceptualization; manuscript writing and editing. Sri H. Narayana: Conceptualization; manuscript writing and editing. Gummadi S. Sree: Manuscript writing and editing. Lakshmi D. Bethineedi: Manuscript writing and editing. L. V. Simhachalam Kutikuppala: Manuscript writing and editing; submission. Gnana D. Medarametla: Manuscript editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

None.

ETHICS STATEMENT

None.

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