Katie Gallagher

KNH 304

Short Individual Research Paper

22 October 2013

The Effect of Vitamin D on Chronic Kidney Disease

Chronic kidney disease proves to be a disease that plagues a large part of the population. Chronic kidney disease, or CKD, is defined as the “either by reduced kidney function or by the presence or absence of kidney damage…” (Mirković et al., 2011). Many studies have been conducted to determine the effects of vitamin D on kidney disease. The kidneys work to regulate the body, rid the body of waste, control blood, maintain bone metabolism, and impacts other systems including the immune system, endocrine system, and cardiovascular system. In kidney disease, the patients’ do not have full kidney function so these processes are not being completed. When the kidneys function improperly, the body lacks active vitamin D, which aids in calcium absorption as well as many other activities. Vitamin D plays a vital role in the disease through kidney’s inability to convert 25(OH)-vitamin D into the active form of 1,25 dihydroxy-vitamin D, also known as calcitriol.

Two forms of vitamin D exist. Vitamin D3 is synthesized from the skin after exposure to sunlight and vitamin D2 is typically from dietary sources such as fish or plants. After ingestion or synthesis, the vitamin D continues through the liver with the help of 25-hydroxylases in order to produce 25(OH)D3 and 25(OH)D2. These products move through the kidney aided by 1α-hydroxylase thus creating the active form of vitamin D, 1,25(OH)2D. In healthy individuals, the kidney should utilize the calcitriol in order to increase the level of calcium in the blood by uptake of calcium from the intestine to the blood. Calcitriol works to maintain mineral homeostasis and bone metabolism. “The best defined physiological function of 1,25(OH)2D is regulation of calcium and phosphate homeostasis and promotion of bone mineralization and is reviewed elsewhere. In short, 1,25(OH)2D stimulates active absorption of calcium and phosphate from the intestine and their reabsorption by the kidney” (Mirković et al., 2011). Vitamin D is also accountable for building and maintaining strong bones, sustaining accurate levels of calcium in the blood, maintaining the correct level of phosphorus in the blood, inhibiting bones from becoming weak or malformed, and preventing rickets in children and as well as osteomalacia in adults. (Dorough & Colman, 2013).

In chronic kidney disease, the vitamin D absorption does not work as efficiently. CKD patients have a reduced level of 1α-hydroxylase available for the production of active vitamin D even in the very early stages of the disease(Santoro et. al., 2013)**.** “CKD patients exhibit a slow, gradual decrease in the level of 1,25(OH)2D (calcitriol) that parallels the progressive decline in kidney function” (Santoro et al., 2013). The inability of the kidney to produce active vitamin D causes the parathyroid to begin to pull calcium from the bones in order to circulate through the blood. This leads to many other consequences such as osteoporosis, calcium deposits in the skin, and calcified vessels. Once calcium deposits have compromised vessels, the process of calcified vessels cannot be reversed. Subsequently, calcified vessels and arteries will further lead to heart disease. Therefore, the list of complications caused by the lack of active vitamin D proves the imperative nature of the vitamin to CKD.

Due to the crucial role vitamin D plays in kidney function, treatment of vitamin D deficiency takes precedence.

As CKD progresses and renal mass decreases, the ability to produce renal hydroxylated 1,25 vitamin D diminishes and 1,25 vitamin D deficiency ensues.It is therefore necessary to replete 1,25 vitamin D using calcitriol or its analogues to compensate for the compromised production of 1,25 vitamin D, which occurs in the later stages of CKD (beyond Stage 3) so that the classical functions of hormonal 1,25 vitamin D may be addressed. (Williams, Malatesta & Norris, 2009).

Vitamin D is not readily available in most foods and excessive sun exposure is often advised against, consequently making vitamin D difficult to obtain. Therefore, many CKD patients are prescribed a vitamin D supplement. Adequate supplementation may be achieved through oral ingestion. Various forms of vitamin D supplements exist. Some evidence illustrates stronger health benefits from the vitamin D3 supplementation versus the vitamin D2. CKD patients should consult their doctors in order to determine which supplementation will aid them most in their specific cases of chronic kidney disease.

There are many successive benefits to vitamin D therapy. These benefits include immunodulatory and anti-inflammatory effects, vascular effects, regulation of the RAS, and certain effects on glucose metabolism, along with the well-known mineral metabolism function of vitamin D (Xu et al, 2013). Individuals may then become concerned with developing adverse symptoms of vitamin D because it is a fat-soluble vitamin. However, the Nation Center for Biotechnology Information confirms that, “Toxicity does not appear to be a significant problem with vitamin D administration because of a wide margin of safety between doses recommended for repletion and doses considered unsafe” (Williams, Malatesta & Norris, 2009). Hence, vitamin D toxicity is a rare occurrence therefore chronic kidney disease patients should render the treatment of their vitamin D deficiency as a high priority to their health.

Vitamin D therapy in chronic kidney disease patients proves to be highly relevant to the overall health of a client. In normal clients, vitamin D is activated in the kidney to aid various pathways and function to stimulate calcium reabsorption, decrease renin expression, and impact podocyte differentiation factors. Patients living with chronic kidney disease do not have full function of their kidneys, thus 1α-hydroxylase proves incapable of producing the active form of vitamin D, 1,25(OH)2D. CKD individuals experience better life quality as well as longer life expectancy if they successfully address the vitamin deficiency. Treatment of the vitamin deficiency demonstrates vast health benefits in a many different areas. “Growing evidence indicates that vitamin D may have therapeutic potential for patients with CKD that extends beyond its classical role in maintenance of mineral homeostasis and the present use of active vitamin D for the treatment of secondary hyperparathyroidism in CKD…Therefore, addition of vitamin D to conventional therapy may present a promising treatment modality” (Mirković et al., 2011). In conclusion, vitamin D is one of the most critical factors not only in proper kidney function, but also the impact on many other systems in the body factoring into comprehensive health of the body as a whole.

Works Cited

Dorough, H., & Colman, S. (n.d.). Vitamin D and Chronic Kidney Disease. DaVita.com. 2013. Retrieved from <http://www.davita.com/kidney-disease/diet-and-nutrition/diet-basics/vitamin-d-and-chronic-kidney-disease/e/5326>

Mirković, K., van den Born, J., Navis, G., & de Borst, M. (2011). Vitamin D in chronic kidney disease: new potential for intervention. *Current Drug Targets*, *12*(1), 42-53. <http://ehis.ebscohost.com/eds/pdfviewer/pdfviewer?sid=65c5e17d-e102-46e5-a1a8-2bb1a1fe4da4%40sessionmgr11&vid=3&hid=2>

Santoro, D., Gagliostro, G., Bellinghieri, G., Savica, V., Caccamo, D., Ientile, R., & Benvenga, S. (2013). Vitamin D metabolism and activity as well as genetic variants of the vitamin D receptor (VDR) in chronic kidney disease patients. *Journal Of Nephrology*, *26*(4), 636-644. doi:10.5301/jn.5000203 [http://ehis.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=ebbfd586-fe18-4a56-b75b-a48cdf3b047b%40sessionmgr4&vid=2&hid=2](%20http://ehis.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=ebbfd586-fe18-4a56-b75b-a48cdf3b047b%40sessionmgr4&vid=2&hid=2)

Williams, S., Malatesta, K., & Norris, K. (n.d.). Vitamin D and Chronic Kidney Disease. National Center for Biotechnology Information. 2009 autumn; 19(4 Suppl 5): S5–8-11. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2878736/>

Xu, L., Wan, X., Huang, Z., Zeng, F., Wei, G., Fang, D., & ... Li, Y. (2013). Impact of Vitamin D on Chronic Kidney Diseases in Non-Dialysis Patients: A Meta-Analysis of Randomized Controlled Trials. Plos ONE, 8(4), 1-14. doi:10.1371/journal.pone.0061387 <http://ehis.ebscohost.com/eds/pdfviewer/pdfviewer?sid=65c5e17d-e102-46e5-a1a8-2bb1a1fe4da4%40sessionmgr11&vid=3&hid=2>