Dialysis and Transplantation Open Access

Chembio Publishers
Right Choice for Researchers

Editorial *Volume 2; Issue 2*

Role of Vitamin K2 on the Mineralization and Cardiovascular Calcification in Chronic Kidney Diseases and Renal Failure

Yonova D*

Department of Nephrology, Medical University Hospital Lozenetz, Bulgaria

***Corresponding author:** Diana Hrisstova Yonova, Department of Nephrology, Medical University Hospital "Lozenetz", Bulgaria, Tel No: 0877574416; Email: yonovad@abv.bg

Received Date: May 15, 2019; **Published Date:** May 16, 2019

Editorial

Vitamin K - group includes some fat-soluble vitamins. They act as a cofactor of the enzyme γ-glutamyl carboxylase, that activates vitamin K-dependent proteins, influencing haemostasis and vascular and bone health [1,2]. Accumulating evidence demonstrates that chronic kidney disease (CKD) patients suffer from subclinical vitamin K deficiency, that accelerates bone disturbances and soft tissue calcification, associated with affected mineral metabolism in CKD and renal failure [1,2].

The human body does not accumulate vitamin K. Very small amounts can be found in the liver and bones, enough for its functions in just a few days. Vitamin K may be decreased or even absent in the body in case of abnormal absorption (especially with prolonged intake of antibiotics and anticoagulants, as). In addition, the need for this vitamin may be greater than the amount normally taken with the food [1,2]. Vitamin K comes in two forms: Vitamin K1 (phylloquinone) found in plants, and vitamin K2 (menaquinone) found in meat, egg yolk, and dairy products and in some fermented plant's foods. Most vitamin K2 is contained in a Japanese food (named "Natto") from fermented soy. The vitamin is also synthesized by the intestinal microflora of the body. It is said that menahinone-7 (the form of vitamin K2) remains longer in blood serum than any other form of vitamin K. It is absorbed very well by the human body [1-3].

Vitamin K1 influences blood coagulation, preferably in the liver. Vitamin K2 plays an important role in the process of mineralization, because it activates osteocalcin (OC), released from osteoblasts, which bind calcium (Ca) and accumulates it in the bones. There are studies that show that vitamin K2 deficiency and Ca excess in the blood stream can lead to Ca deposits and calcification of blood vessels. Vitamin K2 has been found to be involved in the activation of the matrix Gla protein (MGP), which inhibits the accumulation of Ca in the aorta and other blood vessels. Deficiency of vitamin K2 can cause cardiovascular calcification (CVC) [3-5].

Patients with chronic kidney diseases (CKD) and chronic renal failure (CRF), on conservative or dialysis treatment, suffer from accelerated CVC. The vitamin K2-dependent MGP is one of the most powerful inhibitors of vascular calcification, but the patients with CRF have proven high levels of the inactive form of MGP (dp-uc-MGP), due to K2 deficit (reduced dietary intake, worsen gastrointestinal absorption). They may benefit from pharmacological doses of vitamin K2 (menaquinone) – a novel approach to improve the calcification inhibitory activity of MGP [6,7].

In recent years, the opinion for pathogenesis of vascular calcification in chronic kidney disease (CKD) have changed significantly. Previously, it was considered an

Citation: Yonova D. Role of Vitamin K2 on the Mineralization and Cardiovascular Calcification in Chronic Kidney Diseases and Renal Failure. Dialysis Trans OA 2019, 2(2): 180010.

entirely passive process, associated with an elevated calcium × phosphorus product in the extracellular fluid. However, it is now clearly recognized, that vascular calcification is an actively regulated process including phenotypic transformation of vascular smooth muscle cells (VSMCs) into osteoblast-like cells and deficiencies of calcification inhibitors [4,5]. Matrix Gla protein (MGP) is one of the strongest local inhibitors of vascular calcification acting in the vessel wal. The fully maturated MGP has undergone two types of post-translational modification: γ-glutamate carboxylation and serine phosphorylation [6-8]. The process of γ-glutamate carboxylation is vitamin K dependent. Circulating forms of MGP are decarboxylated, uncarboxylated (dp-uc MGP) an reflect the extent of vascular calcification and the availability of vitamin K in the vessel wall [2,8,9].

MK-7 belongs to the long-chain menaquinones, which—in contrast with phylloquinones and short-chain menaquinones—are incorporated into low-density lipoproteins and transported to extrahepatic tissues such as the arterial vessel wall, where it seems to be a preferred co-factor for vascular carboxylase [2,3,6]. The optimal dose to achieve this goal is presently unknown, but some authors found a dose-dependent effect of supplementation of MK-7 on MGP activation without an attenuation of the effect for the highest dose used [9-11]. The linear relationship between MK-7 dose and the decrease in dp-uc-MGP and the absence of a plateau phase suggests that even higher doses of MK-7 may be successful aiming at maximal MGP activation. Another proven positive effect of the active MK-7 is activation of osteocalcin and its beneficial impact on osteoblasts and bone mineralization [2,10,11].

The influence of Vitamin K2 on mineral metabolism is found in humans without kidney diseases, but is of particular importance in patients with CKD and CRF, including those on dialysis treatment, because the latter have severely impaired mineral metabolism. Furthermore, the need for vitamin D and calcium supplementation in the patients with CRF poses a risk of iatrogenic hypercalcemia with subsequent deposition of soft tissue calcifications. A treatment with MK-7 would protect such a calcification, because vitamin K2 plays a regulatory role, directing calcium in the right tissue, i.e. to the bone structures in the human body [9-11].

References

1. Fusaro M, Gallieni M, Rizzo MA, Stucchi A, Delanaye P, et al. (2017) Vitamin K plasma levels determination in human health. Clin Chem Lab Med 55(6): 789–799.
2. Beulens JW, Booth SL, van den Heuvel EG, Stoecklin E, Baka A, et al. (2013) The role of menaquinones (vitamin K2) in human health. Br J Nutr 110: 1357-1368.
3. Cozzolino M, Mangano M, Galassi A, Moe SM, Chen NX (2019) Vitamin K in Chronic Kidney Disease. Nutrients 11(1): 168.
4. Moe SM, Chen NX (2008) Mechanisms of vascular calcification in chronic kidney disease. J Am Soc Nephrol 19(2): 213-216.
5. Schoppet M, Shroff RC, Hofbauer LC, Shanahan CM (2008) Exploring the biology of vascular calcification in chronic kidney disease: what's circulating? Kidney Int 73(4): 384-390.
6. Cranenburg EC, Koos R, Schurgers LJ, Magdeleyns EJ, Schoonbrood TH, et al. (2010) Characterisation and potential diagnostic value of circulating matrix Gla protein (MGP) species. Thromb Haemost 104(4): 811-822.
7. Schurgers LJ, Barreto DV, Barreto FC, Liabeuf S, Renard C, et al. (2010) The circulating inactive form of matrix Gla protein is a surrogate marker for vascular calcification in chronic kidney disease: a preliminary report, Clin J Am Soc Nephrol 5(4): 568-575.
8. Cranenburg EC, Schurgers LJ, Uiterwijk HH, Beulens JW, Dalmeijer GW, et al. (2012) Vitamin K intake and status are low in hemodialysis patients. Kidney Int 82: 605-610.
9. Caluwé R, Vandecasteele S, Van Vlem B, Vermeer C, De Vriese AS (2014) Vitamin K2 supplementation in haemodialysis patients: A randomized dose-finding study. Nephrol. Dial. Transplant 29(7): 1385–1390.
10. Voong K, Harrington D, Goldsmith D (2013) Vitamin K status in chronic kidney disease: a report of a study and a mini-review. Int Urol Nephrol 45(5): 1339–1344.
11. Yonova D, Trendafilov I, Dimitrova V, Georgieva I, Arabadjieva D et al. (2018) Influence of vitamin K2 treatment on some bone-related markers in patients with CKD on HDT. Abstract book of 3rd World Conference of Nephrology. Roma, Italy.