Vitamin D status in hemodialysis; current opinions

Parisa Tajdini1, Sadaf Farnam Nia2, Nabiha Midhat Ansari3, Maryam Farahmandsadr4

Abstract
The adverse clinical implications of vitamin D (vitD) deficiency in hemodialysis (HD) patients are widespread and include bone mineral disorders, cardiovascular disease, infections, and mortality. For example, low vitD values are connected with a heightened risk of fractures, osteomalacia, and secondary hyperparathyroidism. Additionally, low vitD levels have been linked to increased arterial stiffness, left ventricular hypertrophy, and heart failure in HD patients. Moreover, vitD deficiency has been connected with an intensified risk of infections, particularly respiratory tract infections, in HD patients. Finally, multiple studies have found an association between low vitD levels and increased mortality in HD patients.

Keywords: Vitamin D, Hemodialysis, Vitamin D deficiency, Secondary hyperparathyroidism, Osteomalacia, Bone mineral disorders, Cardiovascular disease, Malnutrition

Introduction
Patients undergoing hemodialysis (HD) are at high risk of vitamin D (vitD) deficiency due to impaired renal function, reduced sun exposure, and dietary restrictions (1). Vitamin D deficiency is associated with numerous adverse outcomes in HD individuals, including bone mineral disorders, cardiovascular disease, infections, and mortality (2). This letter on epidemiology and prevention of vitD status in HD individuals aims to summarize the current evidence on vitD status in HD patients, including its prevalence, risk factors, and clinical implications.

Prevalence of vitD deficiency in HD
The prevalence of vitD deficiency in HD patients varies widely depending on the population studied, the assay used, and the definition of deficiency. Several studies have reported that over 80% of HD patients have vitD deficiency or insufficiency, described as serum 25-hydroxyvitamin D [25(OH)D] levels below 30 ng/mL or 50 nmol/L. Additionally, many HD patients have secondary hyperparathyroidism, which contributes to bone mineral abnormalities and further reduces vitD levels (3,4).

Risk factors for vitD deficiency in HD
Multiple factors contribute to the high prevalence of vitD deficiency in HD patients, including reduced synthesis and activation of vitD, increased catabolism and clearance of vitD metabolites, dietary restrictions, and reduced sun exposure. The severity and duration of CKD and the degree of proteinuria are also correlated with lower vitD concentrations in HD patients. Other risk factors for vitD deficiency in HD patients include the female gender, older age, obesity, Black race, and use of certain medications such as glucocorticoids and anticonvulsants (5,6).

Clinical implications of vitD status in HD
Low vitD levels have several adverse clinical implications in HD patients, including bone mineral disorders, cardiovascular disease, infections, and mortality. VitD deficiency is associated with an increased risk of fractures, osteomalacia, and secondary hyperparathyroidism. Additionally, low vitD levels have been linked to increased arterial stiffness, left ventricular hypertrophy, and heart failure in HD patients. Vitamin D deficiency has also been connected with an enhanced risk of infections in HD patients, particularly respiratory tract infections (7,8). Finally, several studies have found an association between low vitD levels and increased mortality in HD patients, although the causal relationship is not yet fully understood (9,10).

The management of vitD deficiency in HD
Managing vitD deficiency in HD patients includes non-pharmacologic and pharmacologic approaches. Non-pharmacologic interventions include dietary counseling

1Clinical Research Development Unit, Amir-Al-Momenin Educational, Research and Therapeutic Hospital, Semnan University of Medical Sciences, Semnan, Iran. 2Nickan Research Institute, Isfahan, Iran. 3Faculty of Medicine, Medical University - Plovdiv, Plovdiv, Bulgaria. 4University of Florida Health, Jacksonville, Florida, USA.
#Both authors contributed equally as first authors.
*Corresponding authors: Maryam Farahmandsadr, Email: Maryam.Farahmandsadr@jax.ufl.edu and Parisa Tajdini, Email: ptajdini@gmail.com

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Implication for health policy/practice/research/medical education
Vitamin D (vitD) is critical in maintaining bone health by regulating calcium, phosphorus, and parathyroid hormone (PTH) levels. In addition, vitD has essential non-skeletal effects, including modulation of the immune system, cardiac and muscular function, and cell proliferation and differentiation. In hemodialysis (HD) patients, several factors contribute to the excessive prevalence of vitamin D deficiency, including impaired renal function, reduced sun exposure, and dietary restrictions. Additionally, many HD patients have secondary hyperparathyroidism, further aggravating vitamin D deficiency by increasing PTH value and reducing vitamin D production and activation.

Factors that affect vitD levels in HD
Hemodialysis patients are at an enhanced risk of vitD deficiency due to numerous factors, comprising reduced sunlight exposure, impaired renal function, malnutrition, and use of vitD-binding medications. Reduced sunlight exposure is significant as vitD synthesis occurs in the skin under sunlight (14). Impaired renal function reduces the creation of active vitD, leading to a reduction in serum concentration. Malnutrition is common in HD patients due to dietary restrictions and loss of appetite, which may ensue due to inadequate intake of vitD. Finally, vitD-binding medications such as phosphate binders and glucocorticoids bind to vitD, thereby reducing its bioavailability (11,15).

Conclusion
Vitamin D deficiency is highly prevalent in HD patients and has numerous adverse clinical consequences. Addressing vitD deficiency through non-pharmacologic and pharmacologic approaches may improve outcomes in this population. However, further research is needed to determine the optimal approach to vitD management in HD patients. Routine monitoring of vitD status should be considered in managing HD.

Authors’ contribution
Conceptualization: Sadaf Farnam Nia, Maryam Farahmandsadr.
Data curation: Sadaf Farnam Nia.
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Investigation: Sadaf Farnam Nia, Parisa Tajdini.
Resources: Parisa Tajdini, Nabiha Midhat Ansari.

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