Open Access https://www.jparathyroid.com

Journal of Parathyroid Disease

Journal of Parathyroid Disease 2024,12, e11260

DOI:10.34172/jpd.2024.11260

Mini-Review

Vitamin D status in hemodialysis; current opinions

Parisa Tajdini[1#*], Sadaf Farnam Nia[2#], Nabiha Midhat Ansari[3], Maryam Farahmandsadr[4*]

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

Please cite this paper as: Tajdini P, Farnam Nia S, Midhat Ansari N, Farahmandsadr M. Vitamin D status in hemodialysis; current opinions. J Parathyr Dis. 2024;12:e11260. doi:10.34172/jpd.2024.11260.

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

Received: 10 February 2024, Accepted: 25 April 2024, ePublished: 1 June 2024

[1]Clinical Research Development Unit, Amir-Al-Momenin Educational, Research and Therapeutic Hospital, Semnan University of Medical Sciences, Semnan, Iran. [2]Nickan Research Institute, Isfahan, Iran. [3]Faculty of Medicine, Medical University - Plovdiv, Plovdiv, Bulgaria. [4]University 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

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.

to increase vitD-rich foods, such as fatty fish and fortified dairy products, and to avoid phosphorus-containing foods, which can worsen secondary hyperparathyroidism (11). Additionally, HD patients should be encouraged to increase sun exposure safely to improve vitD levels. Pharmacologic interventions include vitD supplementation with either native vitD compounds or active vitD analogs, such as calcitriol or paricalcitol. However, the optimal dosage and frequency of vitD supplementation in HD patients are not fully established, and there is a risk of vitD toxicity with high doses of vitD or active vitD analogs (12,13).

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.
Funding acquisition: Sadaf Farnam Nia.
Investigation: Sadaf Farnam Nia, Parisa Tajdini.
Resources: Parisa Tajdini, Nabiha Midhat Ansari.
Supervision: Parisa Tajdini, Sadaf Farnam Nia.
Validation: Parisa Tajdini, Maryam Farahmandsadr.
Visualization: Maryam Farahmandsadr.
Writing–original draft: Parisa Tajdini, Sadaf Farnam Nia.
Writing–review and editing: Nabiha Midhat Ansari, Maryam Farahmandsadr.

Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

Funding/Support

None.

References

1. Lee YJ, Oh IH, Baek HJ, Lee CH, Lee SS. Effects of sun exposure and dietary vitamin D intake on serum 25-hydroxyvitamin D status in hemodialysis patients. Nutr Res Pract. 2015;9:158-64. doi: 10.4162/nrp.2015.9.2.158.
2. Drechsler C, Pilz S, Obermayer-Pietsch B, Verduijn M, Tomaschitz A, Krane V, et al. Vitamin D deficiency is associated with sudden cardiac death, combined cardiovascular events, and mortality in haemodialysis patients. Eur Heart J. 2010;31:2253-61. doi: 10.1093/eurheartj/ehq246.
3. Hovsepian S, Amini M, Aminorroaya A, Amini P, Iraj B. Prevalence of vitamin D deficiency among adult population of Isfahan City, Iran. J Health Popul Nutr. 2011;29:149-55. doi: 10.3329/jhpn.v29i2.7857.
4. Gupta D, Vashi PG, Trukova K, Lis CG, Lammersfeld CA. Prevalence of serum vitamin D deficiency and insufficiency in cancer: review of the epidemiological literature. Exp Ther Med. 2011;2:181-93. doi: 10.3892/etm.2011.205.
5. Krassilnikova M, Ostrow K, Bader A, Heeger P, Mehrotra A. Low dietary intake of vitamin D and vitamin D deficiency in hemodialysis patients. J Nephrol Ther. 2014;4:166. doi: 10.4172/2161-0959.1000166.
6. Jean G, Souberbielle JC, Chazot C. Vitamin D in chronic kidney disease and dialysis patients. Nutrients. 2017;9:328. doi: 10.3390/nu9040328.
7. Galesanu C, Mocanu V. Vitamin D deficiency and the clinical consequences. Rev Med Chir Soc Med Nat Iasi. 2015;119:310-8.
8. Judd SE, Tangpricha V. Vitamin D deficiency and risk for cardiovascular disease. Am J Med Sci. 2009;338:40-4. doi: 10.1097/MAJ.0b013e3181aaee91.
9. Lee J, Bae EH, Kim SW, Chung W, Kim YH, Oh YK, et al. The association between vitamin D deficiency and risk of renal event: results from the Korean cohort study for outcomes in patients with chronic kidney disease (KNOW-CKD). Front Med (Lausanne). 2023;10:1017459. doi: 10.3389/fmed.2023.1017459.
10. da Silva Canhos MM, de Oliveira RC, Modelli de Andrade LG, Caramori JC, Barretti P, Martin LC. Association between vitamin D levels and mortality in hemodialysis patients: a cohort study. Ren Fail. 2020;42:225-33. doi: 10.1080/0886022x.2020.1735415.
11. Martineau A, Jolliffe D. "Vitamin D and human health: from the gamete to the grave": report on a meeting held at Queen Mary University of London, 23rd-25th April 2014. Nutrients. 2014;6:2759-919. doi: 10.3390/nu6072759.
12. Zand L, Kumar R. The use of vitamin D metabolites and analogues in the treatment of chronic kidney disease. Endocrinol Metab Clin North Am. 2017;46:983-1007. doi:

10.1016/j.ecl.2017.07.008.
13. Chen J, Wang J, Kim TK, Tieu EW, Tang EK, Lin Z, et al. Novel vitamin D analogs as potential therapeutics: metabolism, toxicity profiling, and antiproliferative activity. Anticancer Res. 2014;34:2153-63.
14. Bhan I, Burnett-Bowie SA, Ye J, Tonelli M, Thadhani R. Clinical measures identify vitamin D deficiency in dialysis. Clin J Am Soc Nephrol. 2010;5:460-7. doi: 10.2215/cjn.06440909.
15. Cianciolo G, Cappuccilli M, Tondolo F, Gasperoni L, Zappulo F, Barbuto S, et al. Vitamin D effects on bone homeostasis and cardiovascular system in patients with chronic kidney disease and renal transplant recipients. Nutrients. 2021;13:1453. doi: 10.3390/nu13051453.