

Kosz Katarzyna, Remjasz Klaudia, Kuchnicka Aleksandra, Kuchnicka Julia, Zarankiewicz Natalia, Zielińska Martyna, Sapuła Klaudia, Aleksandrowicz Jakub, Siedlecki Wojciech. Vitamin D toxicity – causes, symptoms and diagnosis. *Journal of Education, Health and Sport*. 2022;12(8):975-980. eISSN 2391-8306. DOI <http://dx.doi.org/10.12775/JEHS.2022.12.08.080>
<https://apcz.umk.pl/JEHS/article/view/JEHS.2022.12.08.080>
<https://zenodo.org/record/7018630>

The journal has had 40 points in Ministry of Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of December 21, 2021. No. 32343. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical Culture Sciences (Field of Medical sciences and health sciences); Health Sciences (Field of Medical Sciences and Health Sciences).

Punkty Ministerialne z 2019 - aktualny rok 40 punktów. Załącznik do komunikatu Ministra Edukacji i Nauki z dnia 21 grudnia 2021 r. Lp. 32343. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).

© The Authors 2022;

This article is published with open access at Licensee Open Journal Systems of Nicolaus Copernicus University in Torun, Poland
Open Access. This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author (s) and source are credited. This is an open access article licensed under the terms of the Creative Commons Attribution Non commercial license Share alike.
(<http://creativecommons.org/licenses/by-nc-sa/4.0/>) which permits unrestricted, non commercial use, distribution and reproduction in any medium, provided the work is properly cited.
The authors declare that there is no conflict of interests regarding the publication of this paper.

Received: 02.08.2022. Revised: 07.08.2022. Accepted: 24.08.2022.

Vitamin D toxicity – causes, symptoms and diagnosis

Katarzyna Kosz: 0000-0001-6848-0598; kasiakosz19@icloud.com Samodzielny Publiczny Szpital Kliniczny Nr 4 w Lublinie

Klaudia Remjasz: 0000-0002-0879-7515; remjaszklauadia@gmail.com Absolwent Uniwersytetu Medycznego w Warszawie

Aleksandra Kuchnicka: 0000-0001-8481-7592; kuchnickaola@gmail.com Absolwent Uniwersytetu Medycznego w Lublinie

Julia Kuchnicka: 0000-0003-0409-5695; julia.kuchnicka@me.com Szpital Specjalistyczny w Brzezinach

Natalia Zarankiewicz: 0000-0001-9203-3376; natalia.zarankiewicz@gmail.com Samodzielny Publiczny Szpital Kliniczny Nr 4 w Lublinie

Martyna Zielińska: 0000-0001-8886-8274; martynazielinska52268@gmail.com Samodzielny Publiczny Szpital Kliniczny Nr 4 w Lublinie

Klaudia Sapuła: 0000-0003-2436-0150; klaudiaa.em@gmail.com Samodzielny Publiczny Szpital Kliniczny Nr 4 w Lublinie

Jakub Aleksandrowicz: 0000-0002-4534-9682; jakub.aleksandrowicz01@gmail.com Samodzielny Publiczny Szpital Kliniczny Nr 4 w Lublinie

Wojciech Siedlecki: 0000-0002-9917-5411; wojciechsied@gmail.com 1 Wojskowy Szpital
Kliniczny w Lublinie

Abstract:

Introduction and purpose: This review aims to analyze causes, symptoms and diagnosis of overdosing vitamin D resulting in vitamin D toxicity (VDT).

Material and method: This paper was based on medical articles collected in Pubmed from 2008 to 2021 year. The research has been done by looking through keywords such as “vitamin D” “toxicity”.

Results: The review of studies showed that manifestation of VDT is mainly associated with hypercalcemia and its course can range from asymptomatic to life-threatening, including death. We also draw attention to inappropriate use and widespread of vitamin D products.

Conclusion: There is a high demand for medical health workers to advise patients on possible effects of inappropriate use of vitamin D products and its toxicity. Medical practitioners should be attentive to quickly identify VDT.

Keywords: vitamin D, toxicity

INTRODUCTION:

Vitamin D (cholecalciferol) is a crucial prohormone in human body that regulates calcium and phosphate homeostasis. It is mainly synthesized in the skin under UV influence. Vitamin D undergoes two reactions – 25-hydroxylation in the liver and 1-hydroxylation in the kidney to its active form 1,25-dihydroxycholecalciferol - 1,25(OH)₂D (calcitriol) [1]. Calcitriol influences calcium and phosphate homeostasis by increasing both phosphorus and calcium absorption from intestines [2]. Thus, vitamin D deficiency is related to lower calcium absorption resulting hypocalcemia, bone disorders and secondary hyperparathyroidism [2,3]. In compliance with the American Academy of Pediatrics (AAP) recommended intake of vitamin D for children is 400 IU per day from birth to adolescence [3]. While for adults it ranges from 600 IU to 2000 IU per day, depending on different recommendations [4]. Deficiency of vitamin D concentration is a prevalent and global problem in public health system. In the result, raising awareness of vitamin D insufficiency lead to growing intake of vitamin D supplements. However, increasing number of prescriptions with very high doses of vitamin D without medical surveillance may result in hypervitaminosis D.

CAUSES OF VDT

One of the causes of VTD are formulation and fortification errors in food manufacturing. Some studies indicate that there are marked differences in the actual and stated doses eg. excessive fortification of vitamin D in dairy products, which lead to 56 cases (including 41 that required hospitalization and two deaths) because of VDT [2]. Secondly, there is a raising problem of inappropriate describing and dispensing. The administration of a single very large dose of vitamin D (60 000 IU and above) to treat its deficiency called stoss therapy, may expose patients to potentially dangerous side effects of misuse and overdose. Also, an inappropriate administration of vitamin D can lead to VDT as it was in 19-year-old male case admitted to

hospital with hypercalcemia and acute kidney injury. According to the report, he was using a parenteral mixture intended for veterinary use and containing 5 000 000 IU of vitamin D in order to develop his muscles [2,5].

SYMPTOMS OF VDT

Clinical course of vitamin D overdose may range from asymptomatic to highly-severe, including death [6]. Most common symptoms are these related to hypercalcemia. Largely, it is characterized by renal manifestation, which includes nephrocalcinosis, hypercalciuria or acute kidney injury and neuropsychiatric (psychosis, confusion, stupor or coma). It can also affect cardiovascular system causing hypertension, ST segment elevation, shortened QT interval, first degree heart block and bradyarrhythmias. Last but not least are gastrointestinal problems such as abdominal pain, constipation, pancreatitis, vomiting or polydipsia [7]. Less common symptoms of VDT can be hearing loss and painful periarticular calcinosis [5]. VDT is usually characterized by elevated 25(OH)D concentration (> 150 ng/ml) with soft-tissue calcification, hypercalcemia and hypercalciuria [5,8].

DIAGNOSIS OF VDT

VDT can be diagnosed by its clinical features. An early diagnosis demands scrupulous drug and clinical history. Largely, VDT is the result of overdosage or too frequent dosage of vitamin D among patients with osteoporosis or other diseases that require vitamin D administration [5]. Beside clinical features, the diagnosis of VDT is also determined by elevated 25(OH)D concentration (> 150 ng/ml), suppressed parathormone and usually normal level 1,25(OH)D [5,8,9]. Bearing in mind, that there is a widespread use of vitamin D, it is crucial for general practitioners to be alert to the symptoms of vitamin D overdose among their patients [5].

SUMMARY

Although VDT with manifestation of hypercalcemia is infrequent, it may be also life-threatening. There is a high need to warn patients about possible side effects of misuse of vitamin D as well as for medical practitioners to promptly identify VDT. In each case of hypercalcemia, VDT should be considered as potential diagnosis. Clear verbal and written instructions should be present for prescribed and over-the-counter vitamin D products. Moreover, patients should be advised to read and follow the recommendations carefully.

Bibliography:

1. Rizzoli R. Vitamin D supplementation: upper limit for safety revisited? *Aging Clin Exp Res.* 2021 Jan;33(1):19-24. doi: 10.1007/s40520-020-01678-x. Epub 2020 Aug 28. PMID: 32857334; PMCID: PMC7897606.
2. Taylor PN, Davies JS. A review of the growing risk of vitamin D toxicity from inappropriate practice. *Br J Clin Pharmacol.* 2018 Jun;84(6):1121-1127. doi: 10.1111/bcp.13573. Epub 2018 Apr 16. PMID: 29498758; PMCID: PMC5980613.
3. Çağlar A, Tuğçe Çağlar H. Vitamin D intoxication due to misuse: 5-year experience. *Arch Pediatr.* 2021 Apr;28(3):222-225. doi: 10.1016/j.arcped.2020.12.009. Epub 2021 Jan 19. PMID: 33483193.
4. Pfothauer KM, Shubrook JH. Vitamin D Deficiency, Its Role in Health and Disease, and Current Supplementation Recommendations. *J Am Osteopath Assoc.* 2017 May 1;117(5):301-305. doi: 10.7556/jaoa.2017.055. PMID: 28459478.
5. Marcinowska-Suchowierska E, Kupisz-Urbańska M, Łukaszkiwicz J, Płudowski P, Jones G. Vitamin D Toxicity-A Clinical Perspective. *Front Endocrinol (Lausanne).* 2018 Sep 20;9:550. doi: 10.3389/fendo.2018.00550. PMID: 30294301; PMCID: PMC6158375.

6. Heaney RP. Vitamin D in health and disease. *Clin J Am Soc Nephrol*. 2008 Sep;3(5):1535-41. doi: 10.2215/CJN.01160308. Epub 2008 Jun 4. PMID: 18525006; PMCID: PMC4571146.
7. Lim K, Thadhani R. Vitamin D Toxicity. *J Bras Nefrol*. 2020 Apr 3;42(2):238-244. doi: 10.1590/2175-8239-JBN-2019-0192. PMID: 32255467; PMCID: PMC7427646.
8. Fraser DR. Vitamin D toxicity related to its physiological and unphysiological supply. *Trends Endocrinol Metab*. 2021 Nov;32(11):929-940. doi: 10.1016/j.tem.2021.08.006. Epub 2021 Sep 10. PMID: 34518055.
9. Vogiatzi MG, Jacobson-Dickman E, DeBoer MD; Drugs, and Therapeutics Committee of The Pediatric Endocrine Society. Vitamin D supplementation and risk of toxicity in pediatrics: a review of current literature. *J Clin Endocrinol Metab*. 2014 Apr;99(4):1132-41. doi: 10.1210/jc.2013-3655. Epub 2014 Jan 23. PMID: 24456284.