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Comparison of calcifediol with vitamin D for prevention or cure of vitamin D deficiency

Roger Bouillon [a 1], Jose Manuel Quesada Gomez [b c 2]

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Abstract

Vitamin D deficiency remains prevalent, with about 7% of the world's population living with severe vitamin D deficiency and about one third with mild deficiency. We compare the relative merits of calcifediol or 25-hydroxyvitamin D (25OHD) compared to vitamin D itself for supplementation as to prevent or cure vitamin D deficiency. The intestinal absorption of calcifediol is nearly 100% and thus higher than that of vitamin D itself. Moreover, calcifediol is absorbed by the intestinal cells and transported through the portal vein and thus immediately accessible to the circulation, while vitamin D is transported with chylomicrons through the lymph system. Therefore, in case of fat malabsorption or after bariatric surgery, calcifediol is much better absorbed in comparison with vitamin D itself. Serum 25OHD increases linearly with increasing doses of calcifediol, whereas serum 25OHD reaches a plateau when higher oral doses of vitamin D are used. Calcifediol, on a weight basis, is about 3 times more potent than vitamin D in subjects with mild vitamin D deficiency. This potency is even 6–8times higher than vitamin D when baseline serum 25OHD is higher or when large doses are compared. In conclusion, calcifediol is an alternative option to correct vitamin D deficiency and may even be the preferred strategy in case of intestinal fat

malabsorption, after bariatric surgery or in case of other conditions with suspected impaired 25-hydroxylase activity in the liver.

Section snippets

Brief historic overview: vitamin D and human health

Vitamin D was discovered a century ago as the agent that allowed the prevention or cure of endemic rickets [1]. In the decades after its discovery, widespread implementation of vitamin D supplementation to infants and small children largely eliminated rickets except in countries or populations not able or willing to implement such preventive strategy [2]. Persistent research later on, demonstrated that vitamin D itself is inactive and needs a two-step hydroxylation into 25OHD, and 1,25(OH)2D,…

Strategies for prevention of vitamin D deficiency

There are only a limited number of options to prevent or correct vitamin D deficiency. Nature's solution during evolution was of course the skin synthesis of vitamin after exposure to UVB light. In fact, during most of the human evolution, the problem was probably how to avoid excess vitamin D rather than vitamin D deficiency and therefore there are many mechanisms to protect us from excess vitamin D whereas this is not the case for protection against deficiency [12]. As UV-B light is also a…

General comparison of vitamin D and calcifediol

The first question to be addressed is whether vitamin D itself or a metabolite of vitamin D that does not need a 25-hydroxylation would have biologically relevant actions. We think that there are no good arguments for a direct effect of vitamin D itself on mammalian cells. There are a few (potential) metabolites of vitamin D prior to 25-hydroxylation such as 4-, 20- or 24-hydroxyvitamin D but none of these compounds are present in biologically active concentrations [16]. The same is true for…

25-Hydroxylation of vitamin D

Another major difference between both compounds is the need for 25-hydroxylation of vitamin D, whereas this, of course, is not needed for calcifediol. There are several 25-hydroxylases but CYP2R1 is the most important one working at low substrate

concentrations and working equally well for vitamin D_2 as for vitamin D_3. In addition, biallelic mutations of this gene cause rickets (vitamin D dependent type 2), as first demonstrated in Saudi siblings [30]. Other mutations were found later on in…

Pharmacokinetic differences between vitamin D and calcifediol

Other aspects of the pharmacokinetic differences between vitamin D itself and calcifediol is, apart from a rapid increase in serum 25OHD by calcifediol in comparison with oral vitamin D, is the relative potency of both compounds. There are a number of RCTs comparing the serum 25OHD concentrations after supplementation with either vitamin D or calcifediol. In an overview of 9 RCTs mainly dealing with postmenopausal women with rather poor vitamin D status at baseline (which is in fact one of the…

Conclusions

Vitamin D deficiency remains highly prevalent around the world due to a combination of low vitamin D intake and insufficient vitamin D synthesis in the skin. In view of the well-known effects of the vitamin D endocrine system on the skeleton throughout life and possible beneficial effects on the immune system and general health, it is important to prevent or correct such deficiency. There are only a few strategies to achieve this goal. First, a higher intake of vitamin D rich food is not a real …

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Conflict of interest

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1 ORCID: 0000-0002-6446-3763

2 ORCID: 0000-0003-0990-5650

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