Vitamin D and the prevention of falls: has the time come?

Aging HEALTH

"For an individual who potentially could be harmed by a moderate fall, one that can be remembered months later, it appears reasonable to add vitamin D to the list of nutritional supplements that are likely to be helpful."

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Vitamin D appears to be taking the place of vitamin C as the natural cure all. Even though Linus Pauling may have made an error with vitamin C, there is growing evidence that vitamin D deficiency may play an important role in health and disease. In the developed world, rickets has been generally eradicated as a childhood condition but less extreme manifestations of vitamin D deficiency are now coming to the fore. If we agree upon a definition of vitamin D insufficiency, not necessarily an easy chore, it could turn out to be a common disorder. Much as we define hypothyroidism by increased thyroid-stimulating hormone (TSH), an attempt has been made to define low vitamin D by increased parathyroid hormone (PTH). Unfortunately the relationship is not as clean and we end up with a fuzzy line of demarcation. Depending on the chosen definition, 40–100% of US and European elderly men and women living in the community are reported to be deficient in vitamin D [1,2].

It is important to remember that vitamin D is not thought to have any significant side effects when used in what are considered reasonable dosages; it is an over-the-counter nutritional supplement and is therefore subject to less strenuous review for quality, strength and purity than prescription medications [3]. Side effects, if they occur, may relate to contamination of over the counter preparations. One should actually talk about vitamins D. The two commonly used oral forms are vitamin D2 (ergocalciferol), and vitamin D3 (cholecalciferol). These are both long half-life single hydroxylated forms of vitamin D, which are stored in the liver and then hydroxylated in the kidneys into 1,25-dihydroxy, the active form. Vitamin D is initially produced in the skin by the activity of sunlight. This takes place either *in vivo* in individuals or further up the food chain and is then ingested. Generally, ergocalciferol is produced by the effect of the sun on plants and cholecalciferol is produced by the effect of the sun on animals or the food they eat. Some have argued that cholecalciferol, D3, is more active than D2 [4]. Others argue that they are equivalent [5]. Low vitamin D levels are usually the result of either limited sun exposure, dietary insufficiency or malabsorption.

The conditions suggested to be associated with vitamin D insufficiency keep growing. These include total mortality [6], osteoporosis, muscle weakness, pain [7], cancer, infections [8] and falls [9]. Recent reviews and an editorial in the *Annals of Internal Medicine* argue against the use of vitamin D to prevent cardiovascular disease [10–12]. It is strongly suggested by many observational studies that there is a relationship between vitamin D levels and fracture [13]. In a meta-analysis of published papers, we were not able to show an independent relationship of vitamin D with fracture in clinical trials, except when it was combined with calcium [14].

"I believe we have arrived at the point with vitamin D supplementation where we can safely affirm that it works to prevent something we have chosen to call a fall."

The literature appears to be heading in the direction of showing a relationship between vitamin D deficiency and falls. Unfortunately, falls are not as easy to clinically define as heart attacks or broken bones. Falls represent a hard-to-pinpoint, composite end point. Multiple pathways may lead to falls, such as decreased strength, balance and increased pain. We all know what a fall is when we see one but it is unclear what is being studied when we study falls. We do not have a 'fall meter'. By definition, the event must be a remembered or observed in order to be reported as a fall. Studies have tended to rely on delayed recall. Subjects fill in a card or answer a set of questions at some time after the fall is reported to have taken place. In this situation one could make the mildly facetious suggestion that memory loss protects against 'falls'!

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One strength of prospective, blinded trials is that they do not depend on perfect data ascertainment. As long as those obtaining the data and taking the supplements are blinded, we are able to make a judgment as to the efficacy of vitamin D supplementation to prevent what we have defined as a fall. Enough of these trials have now been carried out to let us draw some conclusions.

I believe we have arrived at the point with vitamin D supplementation where we can safely affirm that it works to prevent something we have chosen to call a fall. A recent meta-analysis looked at all of the high-quality, double-blinded trials they could locate and came to the following conclusions: "Supplemental vitamin D in a dose of 700–1000 IU a day reduced the risk of falling among older individuals by 19%" [15]. The authors were obviously dealing with published studies and had to evaluate the dosages, types of vitamin D, and serum levels that were used in the original studies. This type of approach limits our ability to make specific recommendations outside of a fairly narrow framework but still points us in the right direction.

> "Recommending 700–1000 IU of vitamin D3 per day for adults is not going to cause harm, and is likely to yield benefit for fall prevention..."

Who should take vitamin D, which form and how much in order to prevent falls? The US Department of Agriculture lists the maximum daily safe dose as 2000 IU. This is probably lower than it should be but does not really matter for fall prevention. A dose of 700–1000 IU per day has been shown to reduce the relative risk of falls by 19%. In terms of preventing one fall, this yields a number-needed-to-treat of 11. This is not a magic number or an earth-shaking result but, on a populations basis, it has major health implications. I see no harm and, in fact, a probable benefit for adults from taking 1000 IU of vitamin D per day. It may be wasted on individuals who are out in the sun a great deal or who eat lots of fish or vitamin D supplemented food products, but there is little risk. The differing opinions on which form to use, D2 or D3, may relate to what is being measured and when it is measured. If the cost and availability are the same, it seems logical to use D3 as no one has suggested it is worse and may be better.

For fall prevention, it appears necessary that one should reach a serum level of approximately 60 mmol/l (25 ng/mg). This may or may not be sufficient for other indications. Many authors argue the need for higher levels [16]. There is no known problem with reaching a higher level. Recommending 700–1000 IU of vitamin D3 per day for adults is not going to cause harm, and is likely to yield benefit for fall prevention, as long as we are sure that the recommended vitamin D is not contaminated and that the stated strength is accurate.

Is it worth it for the average individual to spend pennies a day for 1000 IU of vitamin D? The jury is still out when one looks at most of the purported reasons. The pendulum continues to swing back and forth. As far as I can tell, no one has been able to demonstrate any risks associated with this form of supplementation (although kidney stones may increase when calcium is taken in combination with vitamin D) [17]. For an individual who potentially could be harmed by a moderate fall, one that can be remembered months later, it appears reasonable to add vitamin D to the list of nutritional supplements that are likely to be helpful.

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