Vitamin D Deficiency and Supplementation In Patients With End-Stage Renal Disease

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Introduction

Chronic kidney disease (CKD) is a major public health concern with rising prevalence. Vitamin D deficiency (<20 ng/mL) and insufficiency (20–29 ng/mL) are common among patients with CKD undergoing dialysis. The objective was to review current research on vitamin D supplementation for dialysis patients and the effect on their serum vitamin D levels.

There are two main forms of vitamin D found in foods, cholecalciferol and ergocalciferol. Cholecalciferol (vitamin D_3) is taken in the diet from fortified dairy products and fish oils or is synthesized in the skin.[1] The largest quantities of the vitamin in food are found in fatty fish like swordfish, salmon, tuna, and sardines.[1-2] The fortified foods include milk, yogurt, cheese, orange juice, breads and cereals.[1-2]

A major source of vitamin D is what is made in the body from the steroid 5,7-cholestradienol, commonly called 7-dehydrocholesterol.[2-3] This steroid is derived from cholesterol.[2]

The biologically active form of Vitamin D, $1,25(OH)_2D_3$, affects calcium and phosphorus homeostasis and has numerous other diverse physiological functions.[1] The active form of vitamin D is also called calcitriol.[1]

Table 1. Stages of CKD[a]

Stage	Description	GFR (mL/min/1.73 m²)
1	Kidney damage with normal or GFR	≥ 90
2	Kidney damage with mild GFR	89-60
3A	Mild to moderate GFR	59-45
3B	Moderate GFR	45-30
4	Severe GFR	30-15
5	Kidney failure	< 15 or dialysis

CKD, chronic kidney disease; GFR, glomerular filtration rate.

[a]Adapted from the Renal Association. http://www.renal.org/whatwedo/InformationResources/CKDeGUIDE/CKDstages.aspx. Accessed November 16, 2013.

Methods

Subject Populations

The population studied were patients, ages 18 years old and up, with end-stage renal disease undergoing dialysis. The sample size was 70 patients with an effect size of 0.8. A similar study was used to determine sample size.[4] The G*power calculation was completed by using the mean vitamin D levels from a similar study.

Table 1. Vitamin D Parameters

Evaluation	Vitamin D (ng/mL)
Normal	30-100
Insufficiency	21-29
Deficiency	<20

Source: Reference 15.

Data Collection and Analysis

Participants (n=70) diagnosed with end-stage renal disease and undergoing dialysis were assigned to groups that received either 50,000 IU cholecalciferol per week if the patient was deficient (<20 ng/mL) or 10,000 IU cholecalciferol per day if the patient was insufficient (20-30 ng/mL). The serum circulating 25-hydroxyvitamin D [25(OH)D] level was monitored once per month to assess how long vitamin D supplementation is needed to obtain normal serum vitamin D levels (>30ng/mL).

Results

After 3 months, the serum 25(OH)D increased from 14.3 ± 4.7 ng/mL to 43.1 ± 11.0 ng/mL ($p < 0.05$) in the 50,000 IU cholecalciferol per week group (n=30). The 10,000 IU per cholecalciferol per day group (n=40) increased in serum 25(OH)D from 23.9 ± 4.2 ng/mL to 33.5 ± 4.3 ng/mL ($p<0.05$). Results were statistically significant with $p<0.05$.

Implications for Research and Practice

Further research is needed for the specific timeframe that vitamin D_3 supplementation is beneficial for dialysis patients once normal serum levels are achieved to maintain normal levels. Also, more research is needed to determine adequate supplementation timeframe when patients are taking supplements and increasing dietary vitamin D intake and sunshine exposure.

References:
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