

Vitamin D Status in Patients Receiving Home Parenteral Nutrition

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Introduction

Vitamin D has become a hot topic in the world of nutrition because of the emerging science which suggests that vitamin D has pleiotropic effects in a variety of extraskeletal tissues that are important in health and prevention of disease. Vitamin D is actually a prohormone and the physiologic function of vitamin D has expanded beyond the mineralization of bone to include modulation of the immune system and suppression of malignant cells. Research has shown an association between vitamin D deficiency and an increase risk of colorectal cancer, breast cancer and autoimmune diseases.

Recent Institute of Medicine findings support a role for vitamin D and calcium in bone health, but as yet, have not confirmed use of these nutrients in other health conditions. Increases in vitamin D requirements were recommended as noted in the table below.

Dietary Reference Intakes for Calcium and Vitamin D

Life Stage Group	Calcium			Vitamin D		
	Estimated Average Requirement (mg/day)	Recommended Dietary Allowance (mg/day)	Upper Level Intake (mg/day)	Estimated Average Requirement (IU/day)	Recommended Dietary Allowance (IU/day)	Upper Level Intake (IU/day)
Infants 0 to 6 months	*	*	1,000	**	**	1,000
Infants 6 to 12 months	*	*	1,500	**	**	1,500
1-3 years old	500	700	2,500	400	600	2,500
4-8 years old	800	1,000	2,500	400	600	3,000
9-13 years old	1,100	1,300	3,000	400	600	4,000
14-18 years old	1,100	1,300	3,000	400	600	4,000
19-30 years old	800	1,000	2,500	400	600	4,000
31-50 years old	800	1,000	2,500	400	600	4,000
51-70 year old males	800	1,000	2,000	400	600	4,000
51-70 year old females	1,000	1,200	2,000	400	600	4,000
> 70 years old	1,000	1,200	2,000	400	800	4,000
14-18 years old, pregnant/lactating	1,100	1,300	3,000	400	600	4,000
19-50 years old, pregnant/lactating	800	1,000	2,500	400	600	4,000

* For infants, Adequate Intake is 200 mg/day for 0 to 6 months of age and 260 mg/day for 6 to 12 months of age.
** For infants, Adequate Intake is 400 mg/day for 0 to 6 months of age and 400 mg/day for 6 to 12 months of age.

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Challenges in IV Therapy

Multivitamin preparations for individuals who receive home parenteral nutrition (HPN) contain 200 IU per day. Currently, there is not an available injectable form of vitamin D for supplementation which necessitates the use of an alternate source such as an oral supplement.

Methods

Twelve patient cases were reviewed to determine the serum levels of vitamin D as well as the levels of vitamin D supplementation in 12 patients receiving HPN. All HPN patient cases came from one home infusion provider. All patients were managed by a home nutrition support team maintaining electrolytes (including Ca and Phos) within normal limits.

Data collected included: serum vitamin D levels, amount of vitamin D supplementation (outside of the HPN), HPN infusion schedule, diagnosis, gender and age. Most patients (9) were receiving the 50,000 IU vitamin D supplement in the form of D2.

Results

These patients resided in Oregon, Minnesota, New Jersey and Pennsylvania with one each residing in Texas and Washington.

- Age of the patients ranged from 17 to 88
 - Average BMI – 21.9 (males: 22.8; females: 21)
 - Vitamin D levels did not correlate with geographical distribution
- Six males (average age 53.4 years) and six females (average age 58.5 years)
- Diagnosis:
 - 7 – Short bowel syndrome, malabsorption, malnutrition
 - 2 – Malabsorption due to complications of gastric bypass surgery
 - 1 – Small bowel obstruction
 - 1 – Enterocutaneous fistula
 - 1 – Pseudo-obstruction
- Infusion schedule:
 - 9 – Received HPN daily
 - 1 – Received HPN five days per week
 - 1 – Received HPN four days per week
 - 1 – Received HPN three days per week

Summary Table (11 of 12 patients)

Serum Vitamin D (baseline)	24.5 ng/ml (9.7 – 41.9 ng/ml)
Vitamin D intake – MVI	200 IU/day
Vitamin D intake – Oral	16,161 IU/day

Case Examples

Case Example 1

17-year-old male with very poor oral intake due to Lyme disease with chronic inflammation receiving home PN. Initial vitamin D level was 19 ng/ml. After three months of oral supplementation with 50,000 IU of vitamin D weekly, the vitamin D level increased to 36 ng/ml indicating normal absorption. However, the patient was still unable to consume enough orally to meet nutritional needs.

Case Example 2

45-year-old female who had complication of a gastric bypass and had been receiving home PN since May 2008. Initial vitamin D level was of 14.8 ng/ml (July 2008). Oral calcium providing 1,200 mg with 1,200 IU vitamin D3 daily was started. Vitamin D level in October 2009 was 7.5 ng/dl. Oral supplementation with 50,000 IU of vitamin D weekly was initiated. Vitamin D status was rechecked every three to six months with the supplementation dose titrated up based on vitamin D level. The vitamin D level was 21.4 ng/dl in December 2009 with a dose of 50,000 IU of vitamin D four times per week. The dose was increased to five times a week at that time, and as of July 2010, vitamin D level rose to 33.2 ng/dl.

Case Example 3

52-year-old male requiring HPN due to a complication of gastric bypass surgery receiving 350,000 IU per week of supplemental vitamin D. Prior to HPN start, his initial vitamin D level was 9.7 ng/ml. After two months on HPN and supplemental oral vitamin D (50,000 IU daily), the vitamin D level increased to 20 ng/ml.

Case Example 4

29-year-old female with 20+ year history of chronic pseudo-obstruction who is currently receiving HPN four days/week in addition to oral diet. Despite receiving 50,000 units of D3 three times weekly, plus ADEKs multivitamin (400 IU D3) one tablet daily averaging 21,823 IU of oral vitamin D daily for 15 months, her vitamin D level remains low (6.2 ng/ml). Patient is on a regular diet and prefers high fat foods when selecting meals. Patient still has significant problems with N, V and abdominal pain despite the use of anti-emetics and pain medication. Despite receiving 50,000 IU of D3 three times weekly, plus one tablet daily ADEKs multivitamin (400 IU D3) for total average of 21,823 IU of oral vitamin D daily for 15 months, her vitamin D level remains low (6.2 ng/ml).

Conclusion

This data, while limited, indicate that vitamin D levels in this group of HPN patients were below the lowest level of normal. In addition, there was a wide range of oral vitamin D supplementation provided. Further research is warranted to determine if oral vitamin D supplementation is feasible to reach normal serum levels in HPN patients in lieu of an available IV form.