



Risk Factors For Suboptimal Vitamin-D Levels Among Adults With HIV Attending An Urban New Orleans Clinic

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Abstract

Vitamin D insufficiency and deficiency are highly prevalent in populations with HIV, but there is limited data on predictors for suboptimal levels. To determine risk factors for vitamin D insufficiency and deficiency, 185 charts were retrospectively reviewed. Proportions with vitamin D levels < 10 ng/ml, 10 – 20 ng/ml, 20 – 30 ng/ml and > 30 ng/ml were 14.6%, 44.8%, 24.9%, and 15.7%, respectively. Bivariate analysis showed that vitamin D levels < 20 ng/ml were associated with a lower albumin level (p = .02), female gender (p= .0003) and African American race (p = .0001). Tenofovir exposure showed borderline significance (p = .09). African American subjects were the only significant factor in multivariate modeling, with elevated Vitamin D levels. Although little significance was shown, obese persons with a poorer nutritional status and possibly those on tenofovir may also be at higher risk.

Introduction

The high prevalence of low serum vitamin D levels (25-hydroxyvitamin D; 25(OH)D < 30 ng/mL or 75 nmol/L) has been demonstrated in various settings in the general population. Data from the US National Health and Nutrition Survey (NHANES) conducted between 2001 to 2004 revealed only 23% of persons had adequate levels.¹ Studies conducted in several HIV-infected cohorts have had similar findings. Approximately 70% to 87% of the study populations had suboptimal 25(OH)D levels.^{2,3,4,5} Although one study was conducted in Houston, the vast majority of data was generated from subjects residing in the Northeast, Midwest, or West Coast.³ Given the paucity of information on 25(OH)D levels from the south region, a retrospective review on subjects was conducted. Patients in an ambulatory care clinic in New Orleans were enrolled to determine the prevalence of suboptimal 25(OH)D levels and to evaluate risk factors for deficiency and insufficiency.

Methods

A total of 185 subjects were included in the study. Proportions with 25(OH)D levels < 10 ng/mL, 10 – 20 ng/dl, 20 – 30 ng/mL, and > 30 ng/mL were 14.6%, 44.8%, 24.9%, and 15.7%, respectively. Characteristics stratified by 25(OH)D level are shown in Table 1. Men and women were equally represented and were relatively immunocompetent. Median HIV RNA level was 308 copies and median age was approximately 50 years. The study population differed from the total clinic population by having higher proportion of women (p = <.001) and higher proportion of persons older than 50 years of age (p<.001). Charts from 185 patients having at least one visit at the HIV outpatient clinic were retrospectively reviewed between July 2009 and December 2010. Laboratory test, such as CD4 cell counts and HIV RNA levels were collected within a 3 month window of the 25 (OH) D level measurements. Information on selected symptomatology that potentially could be due to suboptimal 25(OH)D levels was ascertained from clinical assessments on progress notes . Specific symptoms included muscle weakness, pain and wasting and chronic pain requiring opiate therapy. Diagnoses of osteopenia and osteoporosis were defined either by DEXA scan results with actual T scores or by clinician assessments based on DEXA scans performed at outside facilities. The chi square test was used to compare proportions. Continuous variables were transformed to reach normality when necessary and t-test were used to compare group means. A logistic regression model was applied to the data to assess for associations while assessing for interaction and controlling for confounding. Models were built in a backward stepwise fashion. The Wald test was used to check for the significance of the beta coefficients. Exponential of the beta coefficients was used to estimate odds ratio and 95% confidence interval. Complex and simpler models were compared using -2Log L test. Alpha error was set at 0.05.

Table 1: Study Population Characteristics by Vitamin D Level

Factor	Vitamin D Level <10	Vitamin D Level 11-20	Vitamin D Level >20	Total
Age (< 50 yrs.)	14 (52%)	43 (52%)	33 (44%)	90 (49%)
Race (AA)	26 (96%)	74 (89%)	47 (63%)	147 (98%)
Sex (males)	16 (59%)	30 (36%)	49 (65%)	95 (51%)
HIV RNA (<400 copies)	12	44	46	102
CD4 (count/ml)	267	399	398	388

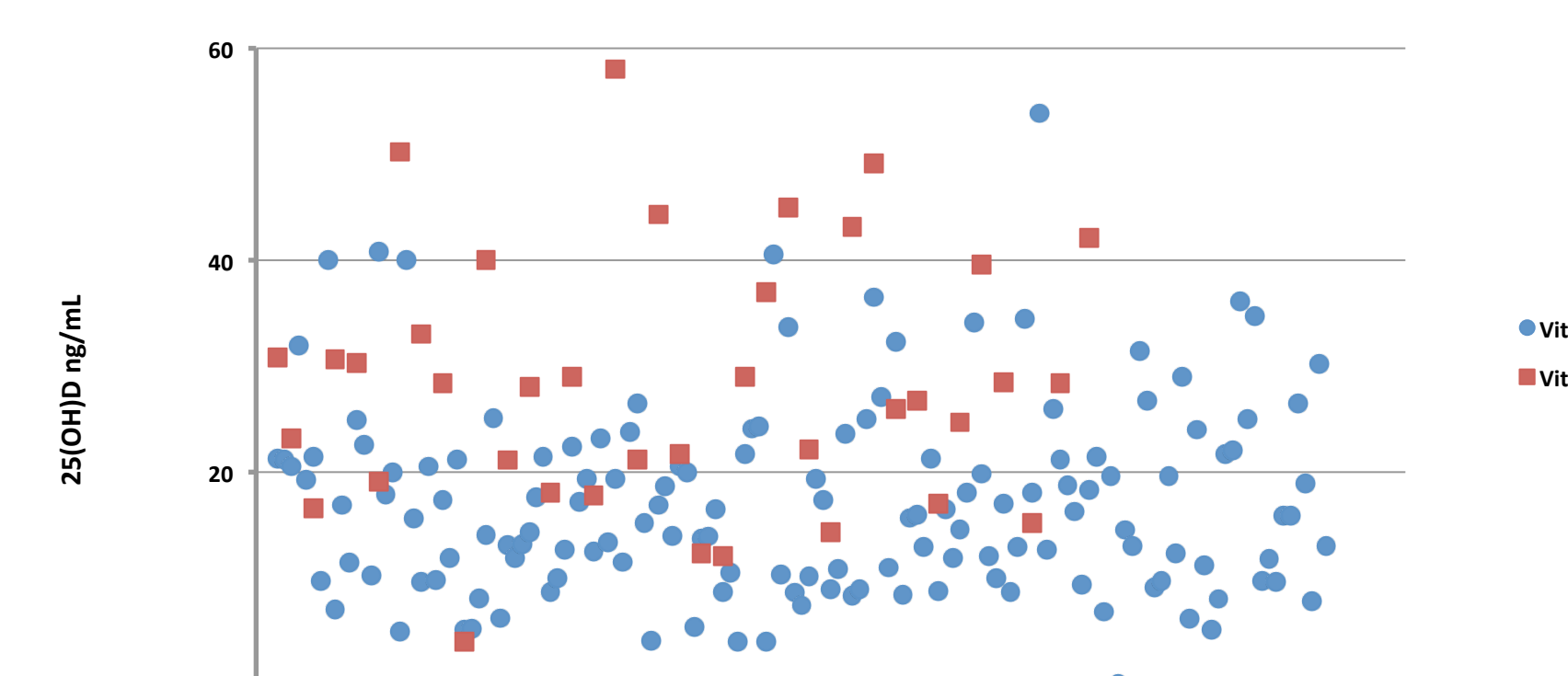
Results

In bivariate analyses, factors correlated with 25(OH)D levels less than 20 mg/mL were African American (AA) race (p < .0001), a lower albumin level (p = .02), female gender (p=.002), a higher body mass index (BMI) (p = 0.04) and higher HIV RNA level (p=.04). Tenofovir exposure showed a trend towards significance (p = 0.09). Specific characteristics not associated with low 25(OH)D levels were age, CD4 cell count, serum creatinine, serum calcium, non-nucleoside reverse transcriptase exposure, protease inhibitor exposure, alcohol use, cocaine use, smoking, and all symptomatology variables (muscle weakness, muscle pain, muscle wasting, and chronic pain). As shown in Table 2, on multivariate analyses the only significant characteristic associated with a 25(OH)D levels < 20 ng/mL was AA race after adjustment for all other factors. This variable was strongly predictive showing AA were approximately four times more likely to experience 25(OH)D deficiency compared to non-AAs. Although women, persons exposed to tenofovir, younger individuals, and person with a poor nutritional status were all more likely to have low 25(OH)D levels, none of these variables remained significant in the multivariable model.

Table 2: Association Between Vitamin D Deficiency and Risk Factors in an HIV Infected Population

Risk Factor	Odds Ratio (crude)	95% CI	Odds Ratio (adjusted)	95% CI
Race (AA vs. W)	6.0	2.7-13.3	4.3	1.8-10.1
Sex (F vs. M)	2.7	1.4-4.8	1.7	0.9-3.4
Age (≤ 50 vs. ≥ 50)	1.4	0.8-2.5	1.1	0.6-2.1
BMI (<> 30)	1.7	0.8-3.6	1.3	0.6-3.1

Graph 1. Vit D distribution by race group



Discussion

The results of this study are remarkably similar to findings from other studies performed in HIV-infected cohorts. Over 84% of our study population had suboptimal 25(OH)D levels. African Americans were found to be a very strong predictor for low levels, even after adjustment for potentially confounding variables. Persons with a higher BMI and lower albumin levels also were at higher risk, although these variables did not reach statistical significant values in multivariate analyses. These findings are consistent with several other studies.^{2,3,4}

African Americans are thought to be more prone to deficiency because the increased skin melanin content interferes with the UV-B required conversion of pre-vitamin D3 to vitamin D3 in the skin, so they do not get as much vitamin D benefit from the sun as Caucasians. Vitamin D is thought to be sequestered in fat cells in obese persons which leads to lower circulating levels which can be hydroxylated to 25(OH)D. The low albumin levels could reflect a poorer nutritional status and thus less vitamin D intake, or an overall poorer health status which would be associated with less outdoor activity and sun exposure. Other studies have found independent associations between elevated parathyroid hormone levels, tenofovir exposure, and 25(OH)D levels. Tenofovir is known to be associated with secondary hyperparathyroidism and loss of bone mineral density (6 – 7). Although efavirenz exposure has been found to be associated with vitamin D deficiency in other studies, this study did not demonstrate the finding which may have been due to the limited number of subjects in the study. Clinicians caring for persons with HIV need to evaluate patients for 25(OH)D deficiency or insufficiency. Additional studies to better define the association between low 25(OH)D levels and specific antiretroviral therapies are warranted.

Selected References

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- 3 Crutchley R :Risk factors for vitamin D deficiency in HIV -1 infected adults in the South Central USA.Abstracts from the 18th International AIDS Conference ,Vienna,Austria .2010:July 21,2010

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