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Vitamin D Deficiency: A Novel Biomarker for Cardiovascular Disease

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Conflicts of Interest: Nil.

Abstract

Background: Vitamin D deficiency is prevalent in most parts of the world. The prevalence of vitamin D deficiency in India in urban area 9-11% and in rural area 3-6%.Coronary artery disease is global health problem and consists of variety of heart illness. Vitamin D deficiency may cause cardiovascular events by a variety of possible biological mechanism.

Aims & Objectives: To study the role of vitamin D as an emerging risk factor for coronary artery disease.

Materials and Methods: The study was carried out in department of Biochemistry, M. G.M. Medical College included 50 patients of coronary artery disease admitted in M.Y.Hospital. The control population comprised of age and sex matched 50 healthy volunteers. Vitamin D was done on ELISA reader and lipid profile estimation was done on fully automated analyzer.

The statistical analysis was done by using SPSS software. The results were expressed as Mean ± SD. The Student t-test was carried out for comparison of the data & P value <0.05 was considered statistically significant.

Results: The study revealed that vitamin D level was found to be significantly lower in cases as compared to controls. We also observed significant difference in mean to total cholesterol, HDL cholesterol and LDL cholesterol in between cases and control.

Conclusion: This study concluded that continues follow up of vitamin D will be helpful for assessment of increased risk of coronary artery disease events beyond the traditional risk factor.

Introduction

Cardiovascular disease (CVD) is globally considered as the leading cause of death and disability including India. [1] The prevalence of cardiovascular disease has almost doubled in Northern India as well over 30 years. Moreover it is estimated that by the year 2020, coronary artery disease (CAD) will be the leading cause of premature death in India. [2] Vitamin D is one of the fat soluble vitamins also known as sunshine Vitamin due to its synthesis in the body following exposure to ultraviolet (UV) B rays, however it is unique in a way that it acts as a prohormone and mediates its functions by binding to a member of nuclear receptor super family, the Vitamin D receptor. [3]. The active form of vitamin D 1,25-dihydroxyvitamin D (1,25(OH)2D), acts as a steroid hormone by binding to the vitamin D receptor (VDR), which is present in many cells throughout the body, including cardiomyocytes, vascular smooth muscle, and endothelium. (4, 5, 6) Vitamin D deficiency is prevalent in most parts of the world. Vitamin D has long been known to be an essential part of bone metabolism, although recent evidence suggests that vitamin D plays a key role in the pathophysiology of other diseases, including cardiovascular disease. Emerging evidence indicates that vitamin D deficiency, cardiovascular disease and endothelial dysfunction are linked together.[7] Endothelial dysfunction is an important antecedent event

in the development of CHD and atherosclerosis.[8,9] Vitamin D is known to affect vascular endothelium directly or indirectly through up regulation of the renin-angiotensin system or via induction of smooth muscle proliferation and a proinflammatory state. A variety of possible biological mechanism (Blood pressure elevation, Insulin resistance , Inflammation , Obesity , Endothelial dysfunction, Vascular remodelling due to hyperparathyroidism) have been proposed by which, vitamin D deficiency may cause cardiovascular events.[10,11,12] . Our study aimed at determined the relationship between vitamin D and coronary artery disease. We hypothesized that this relation might be explained by endothelial dysfunction and atherosclerosis, and development of cardiovascular disease.

Methods and Material

The present study was carried out in the Department of Biochemistry, M.G.M. Medical College, Indore (M.P.) during the period of June 2016 to Nov 2016 after approval from the ethical committee of the institute. Total 100 subjects were included in this study which were categorized into two groups-cases and controls (50 cases and 50 controls). Patients with 20-60 years of age, irrespective of gender were included in the study. Patients who were haemodynamically unstable in shock or heart failure were excluded. Patients who were already taking vitamin D, had known chronic kidney disease, Chronic liver disease, diabetes mellitus, Endocrine dysfunction, Malabsorption syndrome, Renal Rickets were excluded from the study.

5 ml overnight fasting blood sample was collected and subjected to biochemical estimation of 25(OH) vitamin D by enzyme immunoassay method and lipid profile by enzymatic end point method in fully automated analyzer.

All data were analyzed using SPSS statistical software. Results are expressed as mean ± standard deviation. P value <0.05 was considered statistically significant. Student t-test was used to compare means between the groups, and the chi-square test was used to compare proportions between the groups.

Observation & Result

Table 1:- Baseline characteristics in cases and control

Parameter	Cases (Mean ± SD)	Control (Mean ± SD)	P-value
Age	50.34±6.34	45.68±10.6	0.06
Sex (male)	40(80%)	25(50%)	0.103
BMI (≥30) BMI (<30)	15 35	4 46	<0.05*
Hypertension	39	10	<0.05*
Smoking	38	15	<0.005**

Table 2:- Comparison of biochemical parameter between cases and control

Parameter	Cases (Mean±SD)	Control (Mean±SD)	P-value
25(OH)Vitamin D (ng/ml)	20.11±10.39	33.89±15.3	<0.001***
Total Cholesterol(mg/dl)	180.66±30.37	150.34±27.3	<0.005**
Triglycerides(mg/dl)	178.73±34.94	158.02±34.74	<0.05*
HDL-Cholesterol(mg/dl)	30.16±6.45	35.38±5.67	<0.005**
LDL-Cholesterol(mg/dl)	130.38±32.6	100.82±28.06	<0.05*

* Significant

** Highly Significant

*** Very Highly Significant

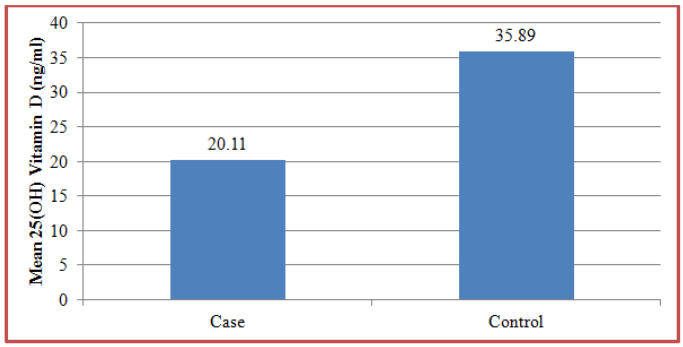

Figure -1 Comparision of 25 (OH) vitamin D level between cases and control

In cases and controls mean value of 25(OH) vitamin D (20.11±10.39 and33.89±15.3, P<0.001), Total cholesterol (180.66±30.37 and 150.34±27.3, P<0.005), triglycerides (178.73±34.94 and 158.02±34.74, P <0.05), LDL cholesterol (130.38±32.6 and 100.82±28.06, P<0.05) and HDL (30.16±6.45 and 35.38±5.67, P<0.005) were obtained.

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Statistically significant differences were seen for serum 25(OH) vitamin D, cholesterol, triglycerides, LDL and HDL levels in cases as compared to controls.

Discussion

In the present study, we have compared the values of 25(OH) vitamin D activity and lipid profile in healthy subjects and patients with myocardial infarction. We found decreased level of 25(OH) vitamin D and increased levels of cholesterol, triglycerides and low density lipoprotein in myocardial infarction patients. Several studies showed vitamin D as a novel risk factor for cardiovascular events and mortality. . In addition, vitamin D has anti-inflammatory effects and prevents cholesterol removal by macrophage and foam cell formation on vessels walls. Also an inverse relation has been seen between vitamin D serum level and coronary artery calcification. [13] Recently, Zittermann *et al*14 reviewed various studies reported association between cardiovascular disease (CVD) and Vitamin D deficiency (VDD) in context of increased prevalence of coronary artery disease (CAD), vascular calcification and essential hypertension. Study by Watson *et al*15 reported inverse correlation of serum 1, 25(OH) 2D3 and presence ofcoronary artery calcification in subjects with hypercholesterolemia who are at high risk for CAD (Framingham cohort). Mahdavi K *et al* (16) reported 72% of Patients with acute coronary syndrome had serum 25-hydroxyvitamin D level of 20ng/ml or less. The observational study by Lindquist, et al (17) has reported a reverse relationship between vitamin D levels and thrombosis. Another prospective study by Giovannucci (18), funded by the National Cancer Institute and the National Heart, Lung, and Blood Institute, vitamin D deficiency was found to be an independent risk factor for development of AMI after adjusting for all known CAD risk factors. Data from prospective observational studies indicate that vitamin D deficiency is also an independent risk factor for stroke. (19,20) *A.K.Pancholia et al(2012)*[21]This study shown that vitamin D as a novel risk factor for cardiovascular events and mortality. Skaaby et al[22] concluded that significant association of hypovitaminosis with hypercholesterolemia. The elevated levels of serum total cholesterol, triglycerides and LDL-C and low level of HDL-C is called dyslipidemia ,which is a major risk factor for CVDs.(23) All the components are associated with increased incidence of coronary artery disease. A large number of studies conducted in the past have provided the basic scientific framework and this study attempts to explore the role of Vitamin D deficiency in the pathogenesis of CAD. Additionally, the prevalence of vitamin D is quite high among CAD patients.

Conclusion

In present study patients of coronary artery disease had significantly low level of vitamin D as compared to individuals without coronary artery disease. Vitamin D deficiency was found to be an independent predictor of CAD after adjusting other risk factors emphasizing that vitamin D can be a potential risk factor for CAD. Hence, our study suggests that vitamin D might be considered as one of the risk factor for cardiovascular events. Our study suggests that vitamin D deficiency and dyslipidemia potentially increase the risk of cardiovascular disease. Several studies have shown strong independent association between hypovitaminosis D and cardiovascular risk. Hence, vitamin D might be considered as one of the risk factor for cardiovascular events. We suggest early screening programme for patients with vitamin D deficiency that could be sign of illness and therefore should be treated promptly.

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