Original Article

Vitamin D deficiency and coronary artery disease

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Abstract

Background: Recent evidence supports an association between vitamin D deficiency and hypertension, peripheral vascular disease, diabetes mellitus, metabolic syndrome, coronary artery disease, and heart failure. **Materials and Methods**: 100 consecutive cases of acute myocardial infarction and angina pectoris were included in this study. Another 100 otherwise age and sex matched healthy individuals formed the control group. The study was a prospective observational study. **Observations:** There was not much difference between the two groups as per the age and sex. 56 patients were obese while 38 were in the control group. Physical activity was slightly more in control group as 12 in patient group and 24 in control group were optimally active. 74% cases were smokers as against 46% in the asymptomatic group. There was no difference in alcohol consumption amongst the groups. Diabetes mellitus was more prevalent in study group (48 vs 22). 75% of patient group did record low Vitamin D levels, while 45% of the control individuals showed lower than 30 ng/ml. Without adjustment, the chance of being affected by coronary artery disease in individuals with vitamin D deficiency is 4.12 (1.64-8.04) times in comparison with those with normal vitamin D and after adjustment with risk factors, i.e., blood pressure, diabetes, smoking, obesity, physical activity and high blood cholesterol, this chance becomes 6.08 times (1.76-18.83). **Discussion:** The results of our study demonstrate that vitamin D deficiency increases the chance of coronary artery disease due to ischemic heart disease and the association between ischemic heart disease and vitamin D deficiency remains significant even after adjustment for cardiovascular risk factors such as diabetes, smoking, obesity, physical activity, high blood cholesterol.
Keywords: Vitamin D deficiency, Coronary artery disease.

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INTRODUCTION

Cardiovascular events are common ailment throughout the world[1]. Vitamin D is known to have a role in calcium metabolism. But recent studies are indicative of a relation between vitamin D deficiency and cardiovascular disease, increased blood pressure, increased insulin resistance, heart failure and fatal strokes.[2,3,4,5,6,7] Holick (2007) found vitamin D deficiency as important cause for death and heart failure with a prevalence of 53% to 83 when they were followed for four to five years.[8]

MATERIALS AND METHODS

This was a prospective observational study undertaken at SVS hospital attached to SVS Medical College, Mahabubnagar Telangana State. The patient group contained 100 consecutive patients admitted to the medicine wards during 1-8-2011 and 31-7-2014. All cases above 40 years admitted for acute myocardial infarction and angina pectoris were included. Their disease was confirmed by clinical and laboratory tests including echocardiography. One hundred age matched individuals who came to hospital for some other minor ailment or relatives of the patients who did not had any evidence of CVS disease were taken as control for the study. The sampling method was convenient non probability method and the sample size was 100 in each

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group. Data collection methods were checklist and questionnaire. Each individual that participated in the study was questioned by the researcher and then weight, height and blood pressure were measured according to the standard protocol and then the checklist was completed. BMI was calculated using the formula "BMI = (Weight in Kilograms / (Height in Meters x Height in Meters)". BMI over 30 considered as obese. A rapid assessment questionnaire for the measurement of physical activity was used. The physical activity was divided in three levels and the individuals were categorized into five levels according to their physical activity. After obtaining written consent from the participants (according to the declaration of Helsinki), a 2.5 cc blood sample were taken from each individual after 8 hours of fasting and collected in a plastic tube and were kept in -20°C in the laboratory freezer. Then, the levels of 25(OH)D in the serum of each sample was determined. The level of fasting blood sugar and cholesterol was also measured. Cholesterol levels of more than 240 mg/dl was considered high[9]. Serum levels of 25(OH) D less than 20 ng/ml was defined as deficient, 21-29 ng/ml as inadequate and 30ng/ml or more was defined as optimal[10]. Hypertension was considered as blood pressure ≥140/90 or the consumption of antihypertensive drugs[11]. Hypercholesterolemia was considered as blood cholesterol ≥240 mg/dl or the consumption of anti-hyperlipidemic drugs[13]. All data thus obtained was subjected to statistical analysis. Statistical tests used were Chi–square, independent t test and log regression. P-value < 0.05 was considered statistically.

OBSERVATIONS AND RESULTS

There was not much difference between the two groups as per the age and sex. 56 patients were obese while 38 were in the control group. Physical activity was slightly more in control group as 12 in patient group and 24 in control group were optimally active. 74% cases were smokers as against 46% in the asymptomatic group. There was no difference in alcohol consumption amongst the groups. Diabetes mellitus was more prevalent in study group (48 vs 22).

Table 1: Showing the anthropological and biochemical parameters

Studied variable	Patient group	Control group	'p' value
Sex – Male	62	58	0.468
Age – 30 – 40 years	14	16	0.642
Age – 41 – 50 years	36	32	0.542
Age – 51 – 60 years	30	30	0.668
Age > 60 years	20	22	0.462
BMI < 30	44	62	0.005
BMI > 30	56	38	0.005
Physical activity 1 (No activity)	22	8	0.005
Physical activity 2 (Low activity)	16	20	0.046
Physical activity 3 (Low weekly activity)	32	26	0.086
Physical activity 4 (Moderate weekly activity)	18	22	0.096
Physical activity 5 (Optimal activity)	12	24	0.005
Smoking	74	46	0.005
Alcohol	82	80	0.268
Hypertension	62	50	0.046
Diabetes mellitus	48	22	0.005
High cholesterol	46	28	0.005
Vitamin D < 30 ng/ml Number of cases	75	45	0.005

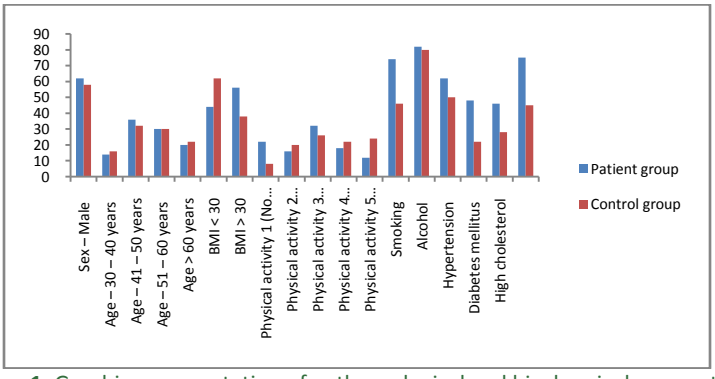

Figure 1: Graphic representation of anthropological and biochemical parameters

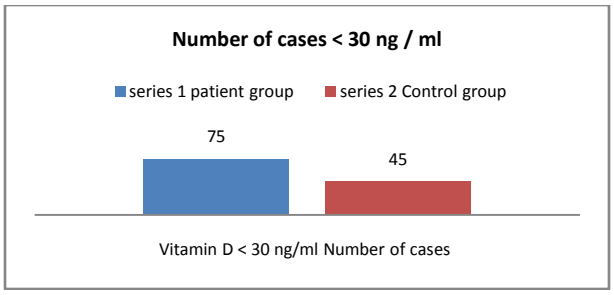

Figure 2: Number of cases of vitamin deficiency

Table 2: Mean values of Vitamin D in this study

Patient group ng/ml	SD	Control group	SD
26.88	14.66	52.52	20.18

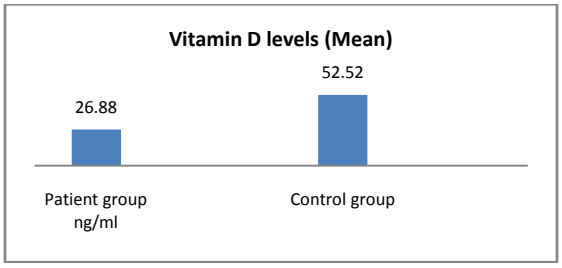

Figure 3: Mean values of Vitamin D in the groups

Table 3: Showing the habit of Smoking and Vitamin D levels

	Patient group – Smokers	Patient group – Non-smokers	Control group – Smokers	Control group – Non-smokers
Number of cases	74	26	46	54
Number of cases Vitamin D < 30ng/ml	58	8	18	0
Mean levels of Vitamin D	24.64 ng/ml	32.84 ng/ml	28.48 ng/ml	54.26 ng/ml

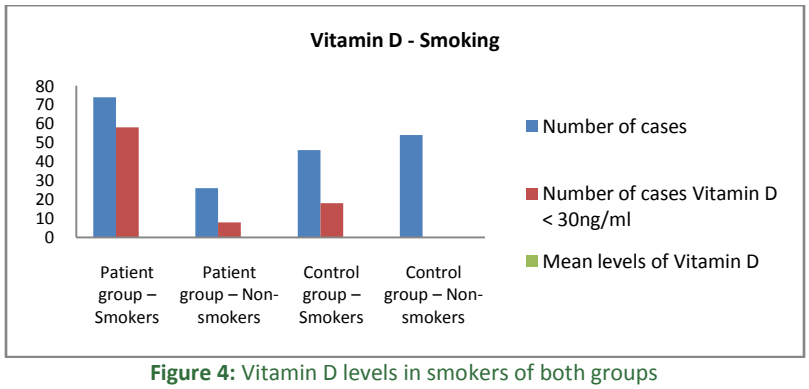

Figure 4: Vitamin D levels in smokers of both groups

The following table 4 highlights the odds ratio for coronary artery disease in individuals with vitamin D deficiency has been presented. Without adjustment, the chance of being affected by coronary artery disease in individuals with vitamin D deficiency is 4.12 (1.64-8.04) times in comparison with those with normal vitamin D and after adjustment with risk factors, i.e., blood pressure, diabetes, smoking, obesity, physical activity and high blood cholesterol, this chance becomes 6.08 times (1.76-18.83).

Table 4: Odds ratio adjusted with various risk factors

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Vitamin D < 30 ng/ml	4.12 [1.64 – 8.04]	4.48 [1.98 – 8.36]	4.69 [1.67 – 7.89]	4.66 [1.56 – 8.16]	4.04 [1.68 – 7.84]	4.58 [1.95 – 10.86]	6.08 [1.98 – 16.32]	6.08 [1.76 – 18.83]	5.98 [1.88 – 18.84]
'p' value	0.002	0.002	0.001	0.001	0.004	0.004	0.004	0.0045	0.004

Model 1=without adjustments; Model 2= adjusted with smoking; Model 3 = adjusted with hypertension; Model 4 = adjusted with diabetes; Model 5 = adjusted with high cholesterol; Model 6 = adjusted with BMI; Model 7 = adjusted with physical activity; Model 8 = adjusted with smoking, hypertension, diabetes, high cholesterol, BMI, Physical activity; Model 9 = adjusted with all risk factors and age and sex

DISCUSSION

The results of our study demonstrate that vitamin D deficiency increases the chance of coronary artery disease due to ischemic heart disease and the association between ischemic heart disease and vitamin D deficiency remains significant even after adjustment for cardiovascular risk factors such as diabetes, smoking, obesity, physical activity, high blood cholesterol. Wang and colleagues revealed that vitamin D deficiency is associated with cardiovascular disease after studying over 1700 participants for a mean of 5.4 years. However in the mentioned study levels lower than 15ng/ml were considered as vitamin D deficiency while we considered levels lower than 30ng/ml as vitamin D deficiency[6]. Kendricka *et al* showed on the patients who underwent coronary angiography a higher mortality in cases with low vitamin D levels[11]. Studies conducted on adolescents, revealed that the low level of vitamin D is obviously accompanied by abdominal obesity, elevated hypertension, and high fasting blood sugar (FBS) and metabolic syndrome[14]. Previous studies also showed that vitamin D deficiency is associated with cardiovascular risk factors such as hypertension, hypercholesterolemia, obesity and diabetes mellitus[12,13,14,15]. Our study showed the vitamin D deficiency is an independent risk factor and clubbed with other unhealthy lifestyle habits add further to the development of coronary artery disease. Similar findings were observed by Siadat and others[13]. Vacek and colleagues found the supplementation of vitamin D was helpful in reversing the disease process of cardiovascular disease and opined to be confirmed with more studies. The limitation of this study is that this was an observational cross sectional study and there was a casual association of vitamin D deficiency and cardiovascular disease and further more sample size was small. Further large multi-centric double blind cross-over studies are needed.

CONCLUSION

In conclusion this study suggests that low levels of 25 (OH) D are associated with prevalent coronary artery disease independent of cardiovascular risk factors. Further investigations could demonstrate the need for vitamin D supplementations in order to prevent atherosclerosis.

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