

The Relationship of Serum 25-Hydroxyvitamin D Concentrations with Mortality among the Patients Diagnosed with the Cardiovascular Diseases

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ABSTRACT

Background: Serum 25-Hydroxyvitamin D is a biomarker used to assess an individual's vitamin D status. Bone health, immune function, calcium and phosphate metabolism is crucially regulated by the vitamin D. Cardiovascular diseases (CVD) are the leading cause of death world widely. Many studies have shown that the vitamin D plays potential role cardiovascular diseases prevention.

Study design: It is a prospective study conducted at Rawal Institute of health sciences, Islamabad for the duration of six months from July 2022 to December 2022.

Material and Methods: The review board committee of the hospital approved the study. In the given study, a total of 300 patients were selected. All these patients were included in this study according to the inclusion criteria. The statistical analysis was conducted. The multivariable Cox regression analysis was done. The immunoassays analyzer was used for vitamin D status assessment.

Results: The average age of the patients were ranging from 56 to 63 years and all of them were suffering from cardiovascular diseases. Different patterns like qualification, educational history with regard to awareness, Smoking patterns, Diabetic medications, and duration of cardiovascular diseases were considered in this study.

Conclusion: Serum 25-hydroxyvitamin D concentrations and all-cause mortality are inversely related. The risk of all-cause mortality is lower in the participants with higher serum 25-hydroxyvitamin D concentrations than those with lower concentrations.

Keywords: Hydroxyvitamin D and cardiovascular diseases.

INTRODUCTION

Serum 25-Hydroxyvitamin D is a biomarker used to assess an individual's vitamin D status. Bone health, immune function, calcium and phosphate metabolism is crucially regulated by the vitamin D¹⁻³. Emerging evidence has proposed that vitamin D is involved in the pathogenesis of various chronic diseases, including cardiovascular disease (CVD). Cardiovascular diseases (CVD) are the leading cause of death world widely. Low vitamin D status is the risk factor for the cardiovascular diseases. Many studies have shown that the vitamin D plays potential role cardiovascular diseases prevention. The suppression of the renin-angiotensin-aldosterone system, increased insulin sensitivity, anti-inflammatory properties, synthesis of parathyroid hormone (PTH) and inhibition of foam cell formation are the cardiovascular resistance mechanisms of vitamin D that have been studied extensively. Numerous studies have reported that the 25-hydroxyvitamin D deficiency has a crucial role in the emergence of cardiovascular disease⁴⁻⁶. Studies have shown that the higher risk of hypertension, myocardial infarction, stroke, and heart failure is observed in the individual having lower vitamin D levels. One proposed mechanism for this association is that low vitamin D levels may contribute to the development of atherosclerosis, a condition in which plaque builds up inside the arteries, leading to narrowed or blocked blood vessels. Additionally, some studies have suggested that vitamin D supplementation may reduce the risk of CVD. There is need to conduct more researches in order to fully understand the relationship between vitamin D and CVD, and to determine whether supplementation may be an effective prevention or treatment strategy. Another hypothesis is that vitamin D deficiency may lead to the development of dyslipidemia. Vitamin D has been shown to regulate the expression of genes involved in lipid metabolism⁷⁻¹⁰. The study aimed to investigate the relation of Serum 25-Hydroxyvitamin D concentrations with mortality among patients with cardiovascular diseases.

MATERIAL AND METHODS

In the given study, a total of 300 patients were selected. All these patients were included in this study according to the inclusion

criteria. At the same time, those patients who did not qualify for the inclusion criteria were not included. The patients were aware of the study objective. Among 300 patients, 111 patients were male, while 189 patients were female. As the patients were selected from the Pakistani population, all of them were Asian by ethnicity. The groups of the patients were made according to the different concentrations of the serum level. The data of each patient was collected and recorded in the form of excel sheets. The statistical analysis was done. The multivariable Cox regression analysis was done. The immunoassays analyzer was used vitamin D status assessment.

RESULTS

The average age of the patients was ranging from 56 to 63 years and all of them were suffering from cardiovascular diseases. Table 1 shows the demographic distribution of the patients with respect to sex, age, and ethnicity.

Table 1: Demographic parameters of the patients

Parameters	Conc. of Serum (nmol/L)			
	<24 nmol/L	24-48 nmol/L	49-70 nmol/L	>70 nmol/L
No. of Patients	50	140	100	10
No. of Males	33 (66%)	9 (6%)	67 (67%)	2 (20%)
No. of Females	17 (34%)	131 (94%)	33 (33%)	8 (80)
Age	56	60	63	63
Asian	50 (100%)	140 (100%)	100 (100%)	10 (100%)

Then, the different characteristic patterns were studied in this population divided with respect to different serum levels. Different patterns like qualification, educational history with regard to awareness, Smoking patterns, Diabetic medications, and duration of cardiovascular diseases were considered in this study. Usually, illiterate people, unaware of a healthy lifestyle has more probability of having cardiovascular disease, and patients with a smoking history, or addicted to smoking have more chances to develop heart diseases but the patients included in our study have fewer smokers suffering from heart disorders. Only a few patients had medication for diabetes or were dependent on insulin. The

duration of cardiovascular diseases was also observed as shown in table 2.

Table 2: Basic characteristics of cardiovascular patients:

Parameters	Conc. of Serum (nmol/L)			
	<24 nmol/L	24-48 nmol/L	49-70 nmol/L	>70 nmol/L
Qualification				
Secondary or higher education	11 (22%)	31 (22%)	21 (21%)	2 (20%)
Lower Secondary	11 (22%)	30 (21%)	33 (23%)	3 (30%)
Illiterate	28 (56%)	79 (59%)	54 (54%)	5 (50)
Smokers				
Smokers	17 (34%)	14 (10%)	10 (10%)	4 (40%)
With Smoking History	11 (22%)	35 (25%)	30 (30%)	5 (50%)
Unknown	22 (44%)	91 (65%)	60 (60%)	1 (10%)
Diabetic medications				
Oral and insulin medication	10 (20%)	70 (50%)	30 (30)	2 (20%)
None	40 (80%)	70 (50%)	70 (70)	8 (80%)
CVD Duration				
Less than 1 year				
1-5 years	12 (25%)	35 (25%)	25 (25%)	2 (20%)
5.1-10 years	15 (30%)	42 (30%)	29 (29%)	3 (30%)
More than 10 years	15 (30%)	35 (25%)	30 (30%)	3 (30%)
C-reactive protein (mg/L) and eGFRcr-cys	8 (15%)	28 (20%)	16 (16%)	2 (20%)

As Table 3 shows the average values of different cardio-metabolic markers in patients divided according to the serum level. Different parameters like triglycerides level, high-density lipids (HDL), cholesterol level, low-density lipids (LDL), blood pressure (systolic and diastolic) C-reactive protein level was also estimated. Then, the statistical analysis was performed and the level of all of the cardio-metabolic patterns was significant, while the level of high-density lipids was not significant as the P value show.

Table 3: Averages of different cardio-metabolic markers:

Parameters	Conc. of Serum (nmol/L)				P-value
	<24 nmol/L	24-48 nmol/L	49-70 nmol/L	>70 nmol/L	
No. of Patients	50	140	100	10	
TGA	186	169	150	139	<0.0012
Total cholesterol (mg/dL)	180	175	171	167	<0.0012
HDL (mg/dL)	45	46	47	46	0.732
LDL (mg/dL)	101	108	103	110	<0.0012
Systolic/diastolic BP	130/80	138/80	140/80	135/75	<0.0012
eGFRcr-cys	80	81	81	80	0.032
C-reactive protein	3.2	3.5	3.0	3.1	<0.0012

DISCUSSION

This study is based on the fact that different cardiovascular diseases are linked with a decrease in the level of vitamin D. The serum level decrease as the disease progress¹¹⁻¹². The serum level is also associated with other respiratory diseases and cancer. Usually, a linear trend is found among the progression of cardiovascular disease and decrease in serum level. It was reported in the few previous studies that level of vitamin D is linked with the mortality rate¹³. So different observational studies also support the fact that vitamin D level is associated with cause-specific and all cause-based mortality. This study is mainly focused on the relationship between different cardiovascular disorders and vitamin D serum levels. This study includes 300 cardio patients, 111 patients were male, and 189 patients were female. All the patients were Asian by ethnicity. All these patients were divided according to the different concentrations of the serum level. The average age of the patients was ranging from 56 to 63 years and all of them were suffering from cardiovascular diseases. The patients were divided according to the serum level because as the disease level became critical the serum level decreases abruptly. Previous study conducted at the Cardiology department of Italy also support this hypothesis and claim that there is strong

association between these two parameters i.e. Vitamin D serum level and cardiovascular disease¹⁴⁻¹⁵.

There are other different parameters like triglycerides level, cholesterol level, high-density lipids (HDL), low-density lipids (LDL), blood pressure (systolic and diastolic), and C-reactive protein level associated with cardiovascular diseases. All of these factors are considered markers for the identification of cardiovascular disease. The level of all these factors changes as heart diseases progress. To verify the link between these factors and Vitamin D serum levels, statistical analysis was performed and it was observed that all of them were linked with Vitamin D levels and cardiovascular diseases except high density lipids. Many other factors of the patients were also noted to find out the more elaborated association of cardiovascular diseases with other parameters like qualification, educational history with regard to awareness, Smoking patterns, Diabetic medications, and duration of cardiovascular diseases. Usually, illiterate people, unaware of a healthy lifestyle have more probability of having cardiovascular disease, they suffered from malnutrition and their diet lacks several important vitamins and other nutrients due to the unavailability of healthy and hygienic food. Smokers have more chances to develop cardiovascular diseases as it disrupts the normal respiration process and ultimately affects the oxygenation of blood. Different drugs and insulin used by diabetic patients also affect the cardiovascular system. The results are in accordance with the study conducted at Cardiology Lab of Europe¹⁶⁻¹⁷.

This study revealed that Vitamin D dependent cardiovascular patients benefited as compared to the patients suffering from cardiovascular diseases without Vitamin D dependency. In the case of Vitamin D dependent cardiovascular diseases, the mortality rate can easily be fixed by providing the optimized level of Vitamin D to the patient and the chances of heart strokes can be minimized up to a limit. Apart from heart stroke, heart failure, and coronary artery diseases can be cured by supplementation of Vitamin D. There are different methods to explain the relationship between the level of vitamin D and cardiovascular diseases. The human cardiovascular system is rich in the receptors of vitamin D. When vitamin D binds to those receptors, it regulates and initiates various activities of the cardiovascular system¹⁸⁻¹⁹. In the blood vascular system, it regulates the flux of calcium ions and also regulates our muscular system. It also has anti-inflammatory effects on blood vessels, thrombogenesis, and clarification of clots in the vessels indirectly improving the cardiovascular system. That's why the cardiovascular system is highly sensitive to the Vitamin D level. All the above mentioned facts support that with the optimum level of Vitamin D, different cardiovascular issues can be minimized²⁰⁻²¹.

This study provides a comprehensive explanation of the association between the level of Vitamin D and other factors involved in the regulation of different cardiovascular diseases. However, it has a few limitations as well. This study is done on a small group of the population with limited ethnicity. Therefore, for a more elaborate statement, the study should be done on a larger population. However, this study also has some limitations. The study was conducted among patients with existing cardiovascular disease, which limits the generalizability of the findings to the general population. The study also relied on a single measurement of serum 25-hydroxyvitamin D concentrations, which may not reflect long-term vitamin D status. Additionally, the study did not measure other vitamin D metabolites, which may have different associations with mortality.

CONCLUSION

This study concludes that vitamin D level is associated with the progression of different cardiovascular diseases directly and indirectly. Cardiovascular diseases depend on vitamin D levels and can easily be controlled with optimized levels of vitamin D supplementation. However, this statement needs more elaborated study with a large group population. Serum 25-hydroxyvitamin D concentrations and all-cause mortality are inversely related. The

risk of all-cause mortality are lower in the participants with higher serum 25-hydroxyvitamin D concentrations than those with lower concentrations.

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