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Effect of Vitamin D Deficiency on the Severity of Coronary Artery Disease in Women Undergoing Angiography

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Abstract

The objective of this study was to investigate the potential link between vitamin D insufficiency and the severity of coronary artery disease (CAD) in women with stable coronary syndrome (CCS). Methods: This cross-sectional research examined two hundred female patients with CCS who were scheduled for coronary angiography. Participants were classified based on their vitamin D levels into three groups: severely deficient (<10 ng/mL), inadequate (10–30 ng/mL), and sufficient (31–100 ng/mL). We also got the test findings for HbA1c and lipids. The SYNTAX score and coronary angiography were used to check for CAD. Results: The severity of CAD was inversely correlated with low vitamin D levels. Patients with significant vitamin D insufficiency, indicated by an elevated SYNTAX score, had symptoms and more coronary involvement. Conclusion:

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Vitamin D insufficiency is a significant predictor of the severity of coronary artery disease in women with chronic coronary syndrome. These findings indicate that the possible use of vitamin D as an adjunct in the management of CAD may warrant consideration. 6. Additional research is necessary to elucidate the function of this treatment method.

INTRODUCTION

Vitamin D (Vit. D is needed for bone mineralization, calcium (Ca2+) metabolism, and many other functions outside of the bones [1]. Coronary artery disease (CAD), dyslipidemia, diabetes, and hypertension are all types of cardiovascular disease (CVD). Recent study indicates a potential association between systemic vascular disease and vitamin D insufficiency. The presence of VDR expression in the circulatory system has been shown, and the correlation between vitamin D levels and the risk of coronary artery disease has been established in several epidemiological investigations [2]. It appears that vitamin D deficiency is prevalent, with numerous research suggesting that a considerable portion of the population, particularly Mexicans residing in regions with limited sunlight exposure, lacks sufficient vitamin D levels in their bloodstream. They think that younger individuals get enough light to keep from getting vitamin D insufficiency, even if their complexion is dark because they are overweight or walking.

Low levels of vitamin D are becoming more and more linked to a number of long-term illnesses, such as diabetes, high blood pressure, rickets, and osteomalacia. Women often have low levels of vitamin D, and hormonal changes that happen after menopause are a risk factor for CVD in postmenopausal women [3]. Hypertension and ViTs levels below 30 ng/ml are linked to CAD, either directly or indirectly. Vascular endothelial damage may be linked to this connection. Coronary angiography uses the SYNTAX score (SS) and the Gensini score to figure out how bad CAD is [4]. The objective

of this study was to examine the correlation between syndromic vitamin D insufficiency and the severity of coronary artery disease (CAD) as measured by the SYNTAX score in female patients with chronic coronary syndrome (CCS). ChatGPT responded by saying that vitamin D deficiency, also known as hypovitaminosis D, can happen when a person doesn't get enough of it. Vitamin D is important for the absorption of calcium and the health of the bones.

Vitamin D can be caused by not getting enough sun, not eating well, or conditions that make it harder for the body to absorb or convert vitamin D into its active form. Obesity, malabsorptive disorders, being older, having dark skin, and having certain medical illnesses (such chronic renal disease or gastrointestinal ailments) are also risk factors. Conversely, inadequate vitamin D consumption can result in rickets in children and osteomalacia in adults, both disorders characterized by weakening bones that are fragile and more susceptible to fractures, and also contribute to osteoporosis. The most common side effects include myalgia, gingivitis, and myasthenia. There is no vitamin C or D in any animal products. Studies reveal that a lack of vitamin D is linked to a higher risk of respiratory infections, more severe COVID-19, and mental health issues such schizophrenia and Parkinson's disease. To find out if you have a vitamin D deficit, doctors look at the amount of 25-hydroxyvitamin D (calcifediol) in your blood. People commonly think that serum 25-hydroxyvitamin D levels below 50 nmol/L are low, and levels below 30 nmol/L are quite low. If the intolerance is severe, the frequency or dosage of the supplements is adjusted accordingly. Patients at high risk (overweight, malabsorptive, not getting much light) may need to take supplements for a long time. Also, a diet high in balanced foods with vitamin D, fatty fish, or fortified dairy can help people get enough of what they need. A weak immune system is also connected to a

lack of vitamin D and has been associated to a number of disorders, including cardiovascular diseases, type 1 and type 2 diabetes, and various malignancies (Chowdhury et al., 2014; Ginde et al., 2009; Holick et al., 2017).

MATERIALS AND METHODS

Methods: This study was conducted at the Department of Cardiology, MTI KTH Peshawar, from January 2023 to July 2023, to ascertain the link between vitamin D levels and clinical parameters of coronary artery disease (CAD) in 200 female patients. The following set of inclusion and exclusion criteria was utilized to evaluate individuals with chronic coronary syndrome (CCS) based on a substantial clinical presentation. Writers' exclusion criteria were severe ischemia, renal insufficiency, and congenital cardiac disease. Everyone gave their written agreement, and a comprehensive history, physical exam, and blood collection were done to get the data. Also, vitamin D levels were divided into three groups: inadequate (<10 ng/ML), insufficient (10–30 ng/ML), and sufficient (31–100 ng/ML). Other tests that went along with these were blood glucose, HbA1c, lipid profiles, and kidney and liver function. Advanced diagnostic techniques, including 12-lead ECG, transthoracic echocardiography, and coronary angiography, were employed to assess left ventricular function, rhythm, and the severity of coronary artery disease as measured by the SYNTAX score. 5.1.1. To verify the scientific validity and trustworthiness of the data, the individuals were categorized into two groups: the Vitamin D Deficient Group (insufficient and deficient) and the Control Group (sufficient or normal).

This study employed SPSS v28 for statistical analysis, including ANOVA, Tukey's post-hoc test, Chi-square test, and Pearson's correlation test, with a significance level of p <

0.05. The robust design of the study sought to clarify the extensive effects of vitamin D on women with chronic coronary artery disease (CAD).

RESULTS

The baseline characteristics, comorbidities, laboratory tests, and angiographic findings were compared among the three groups: Control, Vitamin D Insufficiency, and Vitamin D Severe Deficiency. The groups were comparable for age, height, weight, BMI, and residential distribution, according to the computed averages of these data. Diabetes mellitus, hypertension, and the utilization of beta-blockers, statins, and aspirin were among the comorbidities that exhibited no significant differences between the groups. There was no statistically significant difference between vital indicators like heart rate and blood pressure (systolic and diastolic) and lab values like Hb, PLT, WBCs, and HbA1c. On the other hand, serum creatinine was much higher in the groups with severe and not enough vitamin D. This might mean that low vitamin D levels affect the kidneys. The Vitamin D Insufficiency and Severe Deficiency groups had far higher levels of total cholesterol, triglycerides, and LDL than the Control group. There were also statistically significant variations between the groups in the measurements of these lipid parameters. The SYNTAX score, which shows how complicated CAD is, was much higher in the group that didn't get enough vitamin D. This suggests that these patients had more complicated CAD, even though angiographic data showed no changes in the distribution of CAD. Furthermore, TC, TG, HDL, and SYNTAX scores were significantly correlated negatively with the parameters and vitamin D insufficiency. This could mean that vitamin D and lipid metabolism are connected in some way to the level of CAD complexity.

TABLE 1: BASELINE CHARACTERISTICS, VITAL SIGNS, AND LABORATORY INVESTIGATIONS

Characteristic	Control Group (n=100)	Vitamin D Insufficiency Group (n=100)	Vitamin D Severe Deficiency Group (n=100)	Total (n=300)	p value
age (years)	53.3 ± 8.36	54.9 ± 7.95	55.6 ± 7.59	54.6 ± 8.0	0.297
weight (kg)	81.3 ± 12.47	77.7 ± 12.72	81.6 ± 9.88	80.2 ± 12.03	0.086
height (m)	1.7 ± 0.04	1.7 ± 0.04	1.6 ± 0.04	1.7 ± 0.04	0.097
bmi (kg/m^2)	29.9 ± 4.93	28.4 ± 5	30.1 ± 3.96	29.7 ± 4.63	0.070
residence (urban)	44 (44%)	48 (48%)	53 (53.33%)	98 (49%)	0.686
residence (rural)	56 (56%)	52 (52%)	47 (46.67%)	102 (51%)	-
smoking	8 (8%)	19 (18.67%)	17 (16%)	30 (10%)	0.25
hr (beats/min)	81.9 ± 6.58	82.9 ± 8.89	83.4 ± 7.48	82.7 ± 7.66	0.554
sbp (mmhg)	132.8 ± 10.11	133.3 ± 11.66	134.8 ± 12.56	133.6 ± 11.38	0.596
dbp (mmhg)	83.8 ± 10.67	81.3 ± 7.77	81.9 ± 7.66	82.3 ± 8.38	0.270
hb (g/dl)	11.8 ± 1.11	11.8 ± 1.02	11.7 ± 0.88	11.77 ± 1.0	0.719
plt (×10^9/l)	229.7 ± 46.13	232 ± 46.12	225.7 ± 43.33	229.8 ± 45.0	0.683
wbcs (×10^9/l)	8 ± 1.98	8 ± 2.18	7.4 ± 1.78	7.8 ± 1.98	0.073
fasting glucose (mg/dl)	134.6 ± 52.46	142.1 ± 49.85	131.9 ± 44.22	136.2 ± 49.51	0.419
hba1c (%)	5.7 ± 1.57	5.6 ± 1.55	5.5 ± 1.39	5.6 ± 1.5	0.804
crp (mg/dl)	1.4 ± 0.3	1.4 ± 0.29	1.4 ± 0.17	1.4 ± 0.25	0.556

serum creatinine (mg/dl)	0.7 ± 0.22	1.2 ± 0.33	1.4 ± 0.44	1.1 ± 0.33	<0.001*

TABLE 2: COMORBIDITIES, MEDICATION USE, LIPID PROFILE, ANGIOGRAPHIC DATA, AND CORRELATIONS

Characteristic	Control Group (n=100)	Vitamin D Insufficiency Group (n=100)	Vitamin D Severe Deficiency Group (n=100)	Total (n=300)	p value
diabetes mellitus	56 (56%)	47 (46.67%)	44 (45.33%)	97 (48%)	0.460
hypertension (htn)	36 (36%)	44 (44%)	35 (34.67%)	77 (38%)	0.459
family history of cad	22 (22%)	16 (21.33%)	12 (16%)	39 (19.5%)	0.623
history of mi	10 (10%)	12 (14.67%)	9 (12%)	25 (12.5%)	0.731
aspirin therapy	12 (12%)	13 (13.33%)	12 (12%)	25 (12.5%)	0.962
statin therapy	16 (16%)	12 (16%)	12 (12%)	29 (14.5%)	0.739
beta-blocker therapy	22 (22%)	23 (29.33%)	13 (17.33%)	46 (23%)	0.059
total cholesterol (mg/dl)	134.6 ± 15.66	150.1 ± 19.74	178.5 ± 18.13	154.4 ± 21.42	<0.001*
triglycerides (mg/dl)	115.6 ± 20.53	126.5 ± 18.59	153.6 ± 34.31	131.3 ± 26.85	<0.001*
hdl (mg/dl)	49.6 ± 5.27	48 ± 5.72	49.7 ± 5.55	49.1 ± 5.55	0.130
ldl (mg/dl)	106.2 ± 22.39	136.6 ± 23.62	153 ± 19.58	131.2 ± 25.09	<0.001*
alt (u/l)	28.4 ± 6.03	29.1 ± 5.81	27.5 ± 6.03	28.3 ± 5.72	0.262
ast (u/l)	30 ± 5.91	30.7 ± 6.76	30.5 ± 6.18	30.4 ± 6.28	0.116
left main disease	10 (10%)	10.67 (10%)	21.33 (21%)	29 (9.67%)	0.103

lad (left anterior descending)	30 (30%)	22.67 (22%)	37.33 (37%)	60 (20%)	0.146
rca (right coronary artery)	34 (34%)	37.33 (37%)	40 (40%)	75 (25%)	0.793
lcx (left circumflex artery)	22 (22%)	18.67 (18%)	22.67 (22%)	42 (14%)	0.818
syntax score	9.1 ± 2.33	17.8 ± 2.85	25.9 ± 2.59	17.6 ± 3.64	<0.001*
correlation with vitamin d insufficiency (r value)	-	-	-	-	-
age (years)	0.022	0.793	-	-	-
sbp (mmhg)	0.067	0.417	-	-	-
serum creatinine (mg/dl)	-0.183	0.025*	-	-	-
hba1c (%)	0.061	0.461	-	-	-
crp (mg/dl)	0.001	0.994	-	-	-
total cholesterol (mg/dl)	-0.528	<0.001*	-	-	-
tg (mg/dl)	-0.371	<0.001*	-	-	-
hdl (mg/dl)	0.188	0.021*	-	-	-
alt (u/l)	0.097	0.237	-	-	-
ast (u/l)	0.061	0.455	-	-	-
syntax score	-0.738	<0.001*	-	-	-

DISCUSSION

In affluent nations, the most common cause of mortality is ischemic heart disease. The risk factors for coronary artery disease (CAD) are numerous and can be changed. The evidence supporting the association between low vitamin D levels and an elevated risk of cardiovascular disease and myocardial infarction includes the presence of a vitamin D receptor in cardiovascular cells, which have been shown to produce 1,25-dihydroxy vitamin D, an active metabolite of vitamin D, when exposed to pro-inflammatory stimuli such as PG, air pollution, and cigarette smoke [8]. The SYNTAX score was given to 200 female patients with CCS who were scheduled for coronary angiography as part of the current investigation. Forty of these patients had acceptable vitamin D levels, seventy-five had poor levels, and seventy-five had severe deficits. Prescriptions, symptoms, comorbidities, and baseline characteristics were similar across all groups. These results are consistent with VerDOIa et al.'s study [9], which did not identify any changes in the vitamin D levels of the individuals according to aspirin use or comorbidity criteria. SS was low (< 23) and serum creatinine levels were substantially higher in participants with severe deficiency or vitamin D insufficiency than in controls (p 30 ng/mL; p 23). Vitamin D and HSS were found to be strongly correlated negatively. Moreover, our results are consistent with Sarhan et al. [17], who found no association between vitamin D, age, ALT, and AST.

AUTHOR CONTRIBUTIONS

Inayat ul Haq: concept, methodology, supervision of data collecting, analysis, and authoring of the manuscript; and Noreen Moin: involvement in the design, data collection, and interpretation of clinical data. Samreen Sultana took part in the collection, examination, and interpretation of the data. Overseeing patient enrollment, obtaining

informed consent, and participating in data collection and analysis were all done by Tabassum Iqbal. Parveen Nazia assisted with the clinical assessment and monitoring of the patients during this investigation. Muhammad Imran Younus helped with paper writing and data interpretation, and he offered suggestions on public health matters. A

CONFLICT OF INTEREST

Potential conflicts of interest None of the authors have disclosed any disclosed conflicts of interest.

The authors would like to acknowledge the Department of Cardiology at KTH Peshawar for their collaboration in the patient enrollment and data gathering procedures. The authors express their sincere gratitude to the patients who participated in this study. Conclusion Vitamin D insufficiency was associated with elevated LDL, triglyceride, and total cholesterol levels in female patients with CCS. A greater SYNTAX score in these patients was likewise associated with a more advanced state of CAD.

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