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Vitamin D Deficiency And Its Relationship To The Severity Of Heart Disease In Patients With Dilated Cardiomyopathy

Dr. Rajesh Sukumar Roy[1*], Dr. Sachin Bhausaheb Zambare[2], Dr. Krishna Gautam Shah[3]

[1*]Professor, Department of Medicine, Parul Institute of Medical Sciences and Research, Vadodara, Gujarat, India
[2]Assistant Professor, Department of Medicine, Parul Institute of Medical Sciences and Research, Vadodara, Gujarat, India
[3]Senior Resident, Department of Medicine, Parul Institute of Medical Sciences and Research, Vadodara, Gujarat, India

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***Corresponding Author:** Dr. Rajesh Sukumar Roy
*Department of Medicine, Parul Institute, of Medical Sciences and Research, Vadodara, Gujarat, India

Abstract
Background and Aim: Cardiomyopathy is primarily a disorder of the cardiac muscle that causes myocardial dysfunction and is not the result of disease or dysfunction of other cardiac structures, systemic arterial hypertension and valvular stenosis or regurgitation. This study aims to ascertain the role of vitamin D insufficiency in DCMP patients due to the high incidence of vitamin D deficiency and chronic heart failure caused by underlying DCMP, as well as the paucity of information on DCMP and potential prevention and treatment of these nutritional variables.
Material and Methods: The present analysis is the hospital based cross sectional analysis done in the medical college and the associated hospital. Each patient had a thorough clinical history obtained using the recall approach, together with a history of any related risk factors, in order to rule out any potential aetiologies and categories them as having idiopathic DCMP. After that, the patients had an in-depth clinical evaluation and an Echo. Total 104 subjects were included in the study. Using commercial kits and the chemiluminescence technique on the Beckman Coulter DXI analyzer, vitamin D was detected. Additionally, blood flow across each of the four valves was measured and doppler experiments were conducted. A same number of patients were included in the test group as there were 52 healthy people who served as the control group in this study.
Results: mean 25 OHD3 levels were substantially lower (15.3 ± 5.3 ng/ml vs 33 ± 15.7 ng/ml) and the levels of NT pro BNP and parathyroid hormone (94.5± 26.6 pg/ml vs 48± 17.2 pg/ml) were significantly higher in DCMP patients than in controls. While 12/52 patients in the control group had severe hypovitaminosis D, 24/52 patients in the DCMP group had a severe vitamin D insufficiency.
Conclusion: Compared to controls, patients with DCMP had decreased vitamin D levels, and there was a strong association between vitamin D insufficiency and cardiac performance.

KeyWords: Cardiomyopathy, Hypovitaminosis, Regurgitation, Vitamin D

Introduction

A collection of cardiac illnesses known as dilated cardiomyopathy, which is characterized by progressive heart muscle disease, including dilatation of the ventricles, contractile failure of the left ventricle in the absence of chronic pressure and/or volume overload, and systolic dysfunction. Although there are now several established processes, the 1980 WHO committee reserved the term "cardiomyopathy" for myocardial illness with no known aetiology. Males are more likely to experience it. It is more common in older and middle-aged people.[1,2]

Similar circumstances exist in India. According to studies, cardiovascular illnesses account for 30% of fatalities in rural areas and around 40% of deaths in metropolitan areas in our nation. Because of this, it is now crucial to avoid cardiovascular illnesses. Clarifying the risk factors for CVD and determining each patient's unique risk profile are also critical.[3,4] Recent research has identified vitamin D as an additional risk factor for CVD in addition to the conventional ones. It is associated with metabolic syndrome, hypertension, diabetes mellitus, vascular calcification, inflammation, endothelial dysfunction, and atherosclerosis. It also impacts several other homeostatic systems in the body. Additionally, it is linked to the development of heart failure, stroke, CAD, and sudden cardiac death.[5,6]

A rare and curable cause of DCMP is hypocalcemia brought on by a vitamin D deficiency, particularly in the paediatric population. Myocardial contraction depends on calcium, and hypocalcemia reduces myocardial contractility, which causes congestive heart failure. Treatment for hypocalcemic cardiomyopathy solely involves calcium and vitamin D.[7,8] This study aims to ascertain the role of vitamin D insufficiency in DCMP patients due to the high incidence of vitamin D deficiency and chronic heart failure caused by underlying DCMP, as well as the paucity of

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information on DCMP and potential prevention and treatment of these nutritional variables.

Material and Methods

The present analysis is the hospital based cross sectional analysis done in the medical college and the associated hospital. The patients in the cardiology ward department with age of more than 18 years with the proven DCMP were included in the study. The study was done for the period of one year. The patients who had serious co-morbid medical or surgical illness, ulcerative colitis, renal failure, patients who were already diagnosed with cancer and cardio toxic drugs were excluded from the study. The patients were informed in detail about the study and the written informed consent was obtained prior to the start of the study.

After that, each patient had a thorough clinical history obtained using the recall approach, together with a history of any related risk factors, in order to rule out any potential aetiologies and categories them as having idiopathic DCMP. After that, the patients had an in-depth clinical evaluation and an Echo. Standard blood tests were performed, which included serum vitamin D and a full hemogram. Using commercial kits and the chemiluminescence technique on the Beckman Coulter DXI analyzer, vitamin D was detected. Additionally, blood flow across each of the four valves was measured and doppler experiments were conducted.

A same number of patients were included in the test group as there were 52 healthy people who served as the control group in this study. Every research subject had blood work done, an echocardiogram, and a physical examination.

After an overnight fast (10 to 12 hours), venous blood samples were taken in the morning. The serum was then separated by centrifugation and sent straight to the lab for biochemical examination. Radioimmunoassay was used to determine the serum levels of 25OHD3. Using the immunoassay technique, the serum PTH concentration was evaluated.

Every member of the research group had a transthoracic Doppler echocardiogram performed on them, and they were all wired up to an ECG monitor to measure their heart rates during the test. Complete echocardiographic examination of the patients was established by the same cardiologist, who was blinded to the patient data. To ascertain echocardiographic characteristics, standard apical four-chamber parasternal short and long axis images of the left ventricle were obtained. Using 2-dimensional guided M-mode echocardiography, the aortic annulus, LV end-diastolic, and LV end-systolic diameters were measured in the parasternal long axis view in compliance with the chamber quantification guidelines.

Result

The two groups' baseline characteristics were documented in tabular form. Age, gender, body mass index, and sun exposure did not differ across the groups. In both groups, the prevalence of hypertension and diabetes mellitus was comparable. All research participants' biochemical measures were not substantially different, with the exception of the DCMP patients' lower calcium levels compared to the control group.

The condensed data in Table 1 indicated that the mean 25 OHD3 levels were substantially lower (15.3 ± 5.3 ng/ml vs 33 ± 15.7 ng/ml) and the levels of NT pro BNP and parathyroid hormone (94.5± 26.6 pg/ml vs 48± 17.2 pg/ml) were significantly higher in DCMP patients than in controls. While 12/52 patients in the control group had severe hypovitaminosis D, 24/52 patients in the DCMP group had a severe vitamin D insufficiency.

Table 1: Comparison of Biochemical parameters between the two groups

Variables	Test groups	Control groups
Total cholesterol (mg/dl)	180±20.1	170±16.1
Creatinine	0.7 ± 0.01	0.77 ± 0.5
Calcium	7.9 ± 0.2	7.1 ±0.8
25(OH) D3 (ng/ml)	15.3 ± 5.3	33 ± 15.7
Parathyroid hormone (pg/ml)	94.5± 26.6	51 ± 25.8
NT-proBNP (pg/ml)	3379 ± 1145	155 ± 29

Regarding echocardiographic measurements, individuals with DCMP had considerably lower LV fractional shortening and ejection fraction (LVEF) and significantly greater left ventricular end-diastolic and end-systolic dimensions when compared to the control group. In contrast, there was a positive correlation between 25OHD3 levels and both LVEF and LVFS.

Discussion

There are two types of vitamin D: D2 (ergocalciferol) and D3 (cholecalciferol). Known by many as the "sun shine vitamin," vitamin D3 is produced in the human epidermis by UV light exposure. It may also be taken orally as supplements or as oily fish. Plants produce vitamin D2 through the irradiation of ergosterol. Vitamin D insufficiency is a common public health problem, very often unrecognized and untreated, associated with rickets, dental caries, and growth retardation in children and osteomalacia, osteopenia, osteoporosis.[9,10]

A wintertime lifestyle, staying indoors, avoiding the sun, being older, living farther from the equator, having darker skin, being overweight, smoking, having poor absorption, having renal and liver illness, and taking

medication are all linked to vitamin D deficiency. The most reliable measure of vitamin D status in people without kidney disease is 25hydroxyvitamin D, which is the substrate for both renal and non-renal calcitriol production. It has a higher concentration and a longer biological half-life than 1,25dihydroxy vitamin D, and it reflects both endogenous and exogenous vitamin D production. However, 1,25dihydroxyvitamin D is the biologically active form of vitamin D.[11-13]

In the current study, it was shown that both groups' 25(OH) D3 levels were below normal, with patients with DCMP having much lower levels than controls, who were also patients with other diseases. In DCMP patients, there was an inverse relationship between LV dimensions and 25(OH) D3. This finding was consistent with that of Ameri et al., who similarly observed an inverse relationship between the level of 25(OH) D3 and the LV volume and LVESD in heart failure patients.[14]

Diastolic dysfunction may result from a lack of vitamin D. The Hoorn research, which included 614 individuals from a population-based cohort of older men and women, discovered a tendency towards an increased risk of diastolic dysfunction in those with vitamin D insufficiency.[15]

Research indicates that administering calcitriol, an active form of vitamin D, to individuals undergoing hemodialysis can reverse their heart hypertrophy. More recent clinical trials have shown that in patients with vitamin D-deficient heart failure, vitamin D administration reduces serum pro-brain natriuretic peptide, plasma renin activity, and plasma renin concentration, as well as improves survival and the NYHA functional class. According to a recent study by Dalbeni et al, older individuals with heart failure and vitamin D insufficiency saw a significant increase in their EF values after taking vitamin D supplements for six months.

Limitations

There are a few possible drawbacks to our research. First off, it is difficult to extrapolate the results of this study to all DCMP patients due to the limited sample size. Second, because the current study is observational in nature, it is unable to establish a causal link between vitamin D insufficiency and the DCMP.

Conclusion

Compared to controls, patients with DCMP had decreased vitamin D levels, and there was a strong association between vitamin D insufficiency and cardiac performance.

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