



Research Article

STUDY OF VITAMIN D₃ STATUS IN HEART FAILURE PATIENTS

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ABSTRACT

Background: Vitamin D deficiency is found to be associated with various cardiac condition. Association of biomarkers of heart failure and Vitamin D level will establish new tool and assessing the prognosis of heart failure. **Aim:** To study the status of Vitamin D₃ level and its correlation with various parameters in heart failure. **Material and Method:** This study was conducted in F H Medical College and Hospital, Etmadpur, Agra during period of 2 years i.e. July 2019 to July 2021. Three hundred patients of heart failure were included in the study and Vitamin D₃ level, NT Pro BNP, 2D ECHO, other hematological and biochemical investigation were done. We observed the deficiency of Vitamin D₃ (<30mg/dl) in all patients of heart failure and it was more significant in class IV (NYHA) heart failure patients. Patients with low vitamin D₃ level (<20 mg/dl) had higher pro BNP level of 5352 ng/ml. Ejection fraction was also associated significantly with Vitamin D₃ levels. **Conclusion:** This study was designed to know the effect of Vitamin D₃ deficiency in heart failure. We observed that more than 92% of patients of heart failure were having deficiency of Vitamin D₃ level and largest were in NYHA Class IV heart failure patients (P<0.01). We also observed that high level of Pro BNP was significantly associated with low level of Vitamin D₃ (P<0.01) i.e. is inversely related. Correlation of Ejection Fraction was significantly associated with Vitamin D₃ levels. (P value<0.0001)

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INTRODUCTION

India is a country with very good Sun exposure, though we find that Indians are no better than the people of temperate countries regarding Vitamin D levels and its complications. Emerging and Vast knowledge about non hormonal actions of Vitamin D have created interest in metabolism and extra osseous actions of this hormone. Vitamin D deficiency has been found associated with hypertension, myocardial infarction, stroke, atherosclerosis, peripheral vascular disease, congestive heart failure, endothelial dysfunction and diabetes mellitus. The probable reasons for the effects of Vitamin D on coronary heart disease hypertension and congestive heart failure may be due to combination of these:

- (i) Increase parathyroid levels and associated myocardial, valvular and vascular complications,
- (ii) Inhibition of Vitamin D receptor mediated Gb₁ matrix protein expression related vascular complications,
- (iii) Activation of pro-inflammatory cytokine IL10,
- (iv) Stimulation of Renin-Angiotensin Aldosterone System

With advent of increasing knowledge of Vitamin D functions, new researches are involved in establishing the association between Vitamin D and various cardiac conditions. If Vitamin D deficiency is studied in association with markers of heart failure, then it would be new tool to establish an association between heart failure and Vitamin D levels.

This study was designed to study the status of Vitamin D₃ levels in heart failure patients and its correlation with various heart failure parameters.

MATERIALS AND METHOD

Study was conducted in F H Medical College and Hospital, Etmadpur, Agra, during period of 2 year i.e. from July'19 to July'21 in department of Medicine. Three hundred patients of heart failure were included in study and three hundred three hundred healthy controls were matched with respect to age, sex and food habits was taken. It was a cross sectional, prevalence and case control study.

Inclusion Criteria

- (i) Patient with two major or one major and two minor Framingham's criteria
- (ii) Patients with NYHA class II, III and IV
- (iii) Patients between age 18 to 60 yrs

Exclusion Criteria

- (i) Patients with Vitamin D supplementation in last 3 months,
- (ii) Patient with steroid therapy, chelating agent therapy, malabsorption syndrome, chronic liver disease, chronic renal failure, pregnant or lactating mothers, uncontrolled

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hypertension, diabetes and rickets or any other bone disease.

Patients were admitted in hospital and demographics like age, sex, height, weight, dietary habits, calcium intake and duration of exposure in minutes/week assessed. Detailed clinical examination were done. Laboratory investigations like hematological investigations of blood, biochemical investigations (serum calcium, S. Phosphate, serum creatinine, total serum protein, serum albumin, BUN), special investigations like 25hydroxyvitamin D, NT-Pro BNP level, 2D Echo and ECG were done.

For statistical analysis SPSS (IBM) version 15 used and P value <0.05 were taken as significant

RESULT

A total of 300 patients and 300 healthy controls were taken as per inclusion and exclusion criteria. Age of patients were ranging from 18 to 65 years with mean age 48.64 + 15.63 and mean age of controls were 40.68 + 11.73. Male and female ratio in patients were 1.94:1 while in control were 2.16:1. Comparison of 25(OH)₂ Vitamin D₃ levels between patients and control was 14.98 + 8.82 and 20.40 + 10.18 (P-value< 0.001). Distribution of patients (N= 300) according to NYHA class were 6% (18) patients class II, 65.7% (N=197) in class III, 28% (N=85) in class III and 65.7% (N=197) in class IV respectively. (Table: 1)

| NYHA CLASS | N= 300 | % |
|------------|--------|------|
| NYHA II | 18 | 6.0 |
| NYHA III | 85 | 28.3 |
| NYHA IV | 197 | 65.7 |

Mean Blood Pressure of patients were 132.01 + 35.69 systolic and 79.17 + 19.98 diastolic. Out of 300 patients 44% (N=132) were having Ischemic Heart Disease while 34% (N=102) were having valvular heart disease. Mean Calcium level in patients were 7.54 + 1.19mg/dl and phosphate level were 3.65 + 0.84mg/dl. Mean 25 (OH)₂ vitamin D levels in male patients were 15.67 + 9.52 while in female patients were 11.79 + 5.68 (P Value<0.001). Mean 25 (OH)₂ Vitamin D levels in different class of patients were 20.04 +14.32 in Class II, 14.60 + 8.25 in class III and 13.90 + 7.40 in class IV respectively (P value <0,004) (Table 2)

| 25 (OH) ₂ Vitamin D levels in diifferent Nyha class | |
|--|--|
| Grade of Nyha | 25 (OH) ₂ Vitamin D ₃ Levels |
| II | 20.04 ± 14.32 |
| III | 14.60 ± 8.25 |
| IV | 13.98 ± 7.40 |
| Anova test | P – value <0.004 , significant |

There was progressive fall in Vitamin D level from class II NYHA patients to class IV NYHA patient (P value0.001). (Table :3)

| Association of Nyha Class with Vitamin D among Patients | | | | |
|---|-----------------|----------------|------------------------|-------------------|
| Grade | No. of patients | Deficiency <20 | Insufficienc y (20-30) | Sufficiency (>30) |
| II | 18 | 12 (66.7%) | 4 (22.2%) | 2 (11.1%) |
| III | 85 | 67 (78.8%) | 12(14.1%) | 6 (7.1%) |
| IV | 197 | 143 (72.6%) | 54 (27.4%) | 0 (0%) |
| P-value | <0.001 | | | |

Similarity trend of Vitamin D level was observed in ejection fraction also (P value <0.001). (table: 4)

| Correlation of Vitamin D level with ejection fraction | | |
|---|-----------------------------|---------------------|
| | Ejection Fraction Mean ± SD | P – Value |
| Deficiency <20 | 25 ±7.84 | < 0.001 Significant |
| Insufficiency 20-30 | 32 ± 4.52 | |
| Sufficiency >30 | 345.56 ± 8.52 | |

NT-Pro BNP levels were significantly related to Vitamin D level and value was inversely related (P-value <0.0001) (table: 5).

| Correlation Between Nt-Pro Bnp Level and Vitamin D Levels in Patients | | |
|---|------------------------------|----------|
| Vitamin D Level | NT – Pro BNP Level Mean ± SD | P value |
| Deficiency (<20) | 13968 ± 9976,25 | < 0.0001 |
| Insufficiency (20-30) | 14692 ± 1134.26 | |
| Sufficiency (>30) | 5761 ± 5438.27 | |

DISCUSSION

Prevalence of Vitamin D is quite common in Indian population. Yet it is more underdiagnosed and under treated nutritional deficiency [10]. Vitamin D deficiency is not only responsible of skeletal but also extraskelatal disease[3,6,5]. In our study the females were with average 11.79 ± 5.68 were having more deficiency as compared to male 15.67±9.52(p <0.001). Tandon et al[8,11,14] were also had similar observation. In previous studies, it was concluded that Vitamin D deficiency was associated with increased prevalence of Myocardial Dysfunction, heart failure and sudden cardiac death[11,2,9]. In our study we observed significant association of vitamin D level with heart failure and there was direct correlation with degree of deficiency of vitamin D and severity of heart failure (P-value < 0.004). It is consistent to previous studies we also observed significant inverse correlation with Vitamin D level and NT pro BNP[2,13]. We observed that patient with low Vitamin D level (<20ng/ml) had higher NT-pro BNP level (average 13968) as compared to patient with sufficient Vitamin D level (>30ng/ml) were having NT pro BNP level of average 5764 (P-value <0.0001). Our study showed positive correlation between ejection fraction and vitamin D level (P-value<0.001) . These findings are similar to earlier studies[1,4,15,7]. Tascin et.al.[12] had demonstrated endothelial dysfunction in patients with low Vitamin D and observed improvement in endothelial function parameters after vitamin D₃supplementation.

CONCLUSION

Our study was a cross sectional case control study (age and sex matched among controls). We concluded that

- (i) 92% patients of heart failure were deficient in Vitamin D levels
- (ii) Class IV NYHA patients had lowest level of vitamin D levels
- (iii) Higher NT pro BNP level were seen in patients with low Vitamin D level (an inverse relationship)
- (iv)Correlation of ejection fraction was also found statistically significant with Vitamin D values.

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Conflicts of Interest

None

Ethics

Approved by Ethical Committee of F H M C, Etmadpur, Agra

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