Research Article

Vitamin D Deficiency in Acute Myocardial Infarction and its Association with Diabetes

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Abstract:

Background: Vitamin D deficiency is a global public health problem. Vitamin D deficiency is linked to a number of non skeletal major chronic diseases like cardiovascular disease.

Objectives: To determine the frequency of vitamin D deficiency in patients presenting with ST segment elevated myocardial infarction.

Methods: During the study period, 150 patients fulfilling the selection criteria of ST segment elevation Myocardial infarction were included in this study. A blood sample for 25-hydroxyl vitamin D level was drawn for each patient. Vitamin D deficiency was defined as less than or equal to 20g/dl. Vitamin D deficiency was stratified with demographics such as age, gender, and Comorbids such as smoking and Diabetes.

Results: The mean age of the patients was 51.6±6.7 years. There were 80 (53.3%) male and 70 (46.7%) female patients. There were 52 (34.7%) smokers and 55 (36.7%) patients had diabetes mellitus as Comorbids. The mean serum vitamin D level was 23.46±0.82 ng/ml. Sixty-four patients (49.3%) had vitamin D deficiency with levels below 20ngml, while another 46(30.6%) had insufficient Vitamin D levels in ranges of 21-30ng/ml. There was no association of age, gender, smoking or Diabetes history with vitamin D deficiency (p value >90.05 for all these variables).

Conclusion: Vitamin D deficiency is present in over half of patients with ST elevated Myocardial infarction. Only 20% of patients with acute myocardial infarction had normal vitamin D values, with remaining having insufficient levels. The deficiency was not associated with gender, age, or comorbidity such as smoking or Diabetes.

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Introduction:

Vitamin D deficiency is a global public health problem and is very often under recognized and untreated. The common causes of Vitamin D (Vit D) insufficiency include limited sunlight exposure due to multiple reasons (indoor lifestyle, sun avoidance strategies, distance from the equator, increased skin tone, winter season), malabsorption, certain medications like antiepileptics, steroids, and renal and liver disease, function of which are necessary for Vit D activation[1,2]. Although the biologically active form of vitamin D is 1,25 dihydroxy vitamin D, but measurable and clinically useful form is 25- hydroxyvitamin D, which is the substrate for the renal and nonrenal production of calcitriol[4,5]. Vitamin D deficiency is defined as a Vit D level of <20 ng/mL and insufficiency as 21–29 ng/mL[6]. The cut-off values for insufficient or deficient vitamin D level vary among different professional authorities. Major associations of Vitamin D deficiency are with musculoskeletal system manifesting as rickets, and growth retardation in children and osteomalacia, decreased muscle strength, falls, and increased risk of fracture in adults[7]. Vitamin D deficiency, however, is linked to a number of nonskeletal major chronic dis-

eases, especially cardiovascular diseases as well. Multiple different types of studies (both laboratory studies, and epidemiologic research) have suggested the important role of Vit D in reducing the risk of cardiovascular disease[8]. Vitamin D deficiency leads to a number of cardiovascular pathologies such as accelerated atherosclerosis, increasing the prevalence of metabolic syndrome, endothelial dysfunction, and increased prevalence of coronary artery diseases and heart failure[9]. We present here the prevalence of Vitamin D deficiency in patients with ST segment elevation Myocardial infarction (STEMI), the most important acute emergency presentation of coronary artery disease.

Methods:

It was a descriptive cross-sectional study conducted at Punjab institute of Cardiology (PIC) Lahore from July 2018 to December 2018. By using a non probability purposive sampling, Total of 150 cases were calculated by 7% margin of error with 95% confidence level taking expected population proportion of vitamin D deficiency in ST segment elevation of 75%. One hundred and fifty patients presenting to emergency department of PIC with diagnosis of STEMI were recruited after obtaining written & informed consent. STEMI was defined according to diagnostic criteria given by American Heart association (AHA) / European society of cardiology (ESC) guidelines as follows: A Sudden onset of chest pain>30 minutes, accompanied by hyper acute T wave, ST segment elevated (1 mm in chest and >2 mm in limb leads) and significant Q wave on 12 lead Electrocardiogram (ECG)[12]. All these patients received standard of care treatment as per Guidelines[12]. We obtained demographic data of these patients. Patients with history of malabsorption, chronic kidney disease (creatinine >1.5mg/dl and urea >44mg/dl), who have been taking supplemental vitamin D or calcium supplement within a year, with elevated serum transaminases (Alanine Amine Transferase >55U/L), previous history of old myocardial infarction (MI), heart failure, and coronary artery bypass grafting (CABG) were excluded from the study. Blood samples for vitamin D levels were taken and *measured by competitive binding method and measured in ng/ml* Patients were labeled to have diabetes mellitus if they had blood sugar fasting of > 126 mg/dl or blood sugar post prandial of > 200 mg/dl or HbA1c of >6.5% and they had duration of diabetes of at least 3 years or more.

The data were analyzed with SPSS version (20.0). Qualitative variables i.e. gender, smoking and vitamin D deficiency status (Deficient/Normal) were expressed as frequency and percentage. Quantitative variable i.e. age and vitamin D level were expressed as mean±SD. Data was stratified with respect to risk factor (age, gender, diabetes mellites and smoking (>5 pack years). Post stratification Chi Square test was applied with p-value ≤0.05 considered as statistically significant.

Results:

The mean age of the patients was 51.5±6.7 years. Most of the patients (n=135, 90.0%) fell in age group of 40-60 years. There were 80 (53.3%) male and 70 (46.7%) female patients with male to female ratio was 1:1.14. Smoking history was positive in 52 (34.7%) patients. Diabetes mellitus was present as a comorbidity in 55 (36.7%). Mean duration of Diabetes was 7.3±2.2 years. The mean serum Vit D level was 23.46±0.82 ng/ml (Table 1). There were 74 (49.3%) patients with Vitamin D deficiency with serum level in range of 1-20ng/ml, 46(30.6%) patients had insufficient vitamin D levels in range of 21-30ng/ml, and 30 (20.0%) patients had normal serum vitamin D level of above 30ng/ml (Table 2).

Table 3 elaborates stratification of Vit D deficiency according to different demographics such as age, gender,

Table 1: *Baseline Demographic and laboratory characteristics of patients*

Characteristics	Total n=150
Age (Mean± SD*)	51.6±6.7
35-40 years	2(1.3%)
41-50	70(46.7%)
51-60	65(43.3%)
61-70	13(8.7%)
Gender	
Male	80(53.3%)
Female	70(46.7%)
Diabetes	55(36.7%)
Duration of Diabetes **(Mean± SD*)**	7.3±2.2
<5years	13(23.6%)
6-10years	16(29.1%)
>10 years	26(47.3%)
Smoking history	52(34.7%)
Vitamin D Levels **(Mean± SD*)**	23.46±0.82

* **Standard Deviation, n(%)= number(Percentages)**

Table 2: *Distribution of cohort according to Vitamin D serum level, and deficiency status*

Serum levels of Vit D	No of patients (n)	Percentage (%)
1-20 ng (Deficient)	74	49.3
21-30ng (Insufficient)	46	30.6
31-50g and above (Normal)	30	20.0

and comorbidities such as Diabetes, and smoking. In the age group of 30 to 40 years,1 (50%) patient was with Vitamin D deficiency, and no patient had normal levels; in the age group of (41-50 years), 32 (45.7%) patients were deficient in Vit D; in the age group of 51-60 years, 36 (55.3) patients were deficient in Vit D, and in the age group of 61-70 years, 5 (38.4%) patients had deficient Vit D levels(Table 3).Vitamin D deficiency stratification with gender showed that in males, there were 41 (51.2%) patients with Vit D deficiency, 26 (32.5%) with insufficient levels and 13 (16.2%) patients with normal levels. In female patients, 33 (35.3%) pati-ents were deficient, 20 (28.5%) were insufficient and 19 (19.3%) were normal in Vit D levels. Both Age, and gender did not show any statistically significant asso-ciation with Vitamin D deficiency with p=0.80, and 0.46 respectively. Smoking did not show any significant association with Vit D deficiency with levels being deficient in 46.1% in smokers vs 51.0% in nonsmoker (p=0.85). Diabetes mellitus did not show any significant association with vitamin D deficiency. There were 25 (45.4%) patients with Vit D deficiency in Diabetic population vs 50 (51.0%) deficient patients in Non diabetic population of the study (p=0.76).

After stratification of vitamin D deficiency with duration of diabetes mellitus, although the deficiency was higher in patients with greater duration of Diabetes, the association was not statistically significant. 6 (16.1%) patients were Vit D deficient in subgroup with Diabetes duration of less than 5 years as compared to 7(43.7%) and 12 (46.1%) vitamin D deficiency in groups with diabetes duration of 5-8 years and over 8 years respectively (p=0.76) (Table 3).

Discussion:

Vitamin D has a myriad role in both musculoskeletal and non musculoskeletal wellbeing of human body. The study presents our experience of Vit-D deficiency status among patients suffering from STEMI. Only 1/5th

Table 3: *Stratification of Vitamin D deficiency according to different demographic and clinical status*

No of Characteristics	Vit D Deficiency n(%)	Vit D Insufficient n(%)	Vit D Normal n(%)	P- value
Age group				
35-40 years	1(50)	1(50)	--	
41-50	32(45.7)	24(34.2)	14 (20.0)	0.80
51-60	36(55.3)	16(24.6)	13 (20.0)	
61-70 and above	5 (38.4)	5(38.4)	3 (23.0)	
Gender				
Male	41 (51.2)	26(32.5)	13 (16.2)	0.46
Female	33 (47.4)	20(28.5)	17 (24.2)	
Smoking history				
Positive	24 (46.1)	17(32.6)	11 (21.1)	0.85
Negative	50 (51.0)	29(29.5)	19 (19.3)	
Diabetes mellitus				
Positive	25 (45.4)	18(32.7)	12 (21.8)	0.76
Negative	49 (51.5)	28(29.4)	18 (18.9)	
Duration of Diabetes				
=3-5years				
>5-8 years	6(16.1)	5(38.4)	3(23.0)	0.76
>8 -10 years	7 (43.7)	7(43.7)	2 (12.5)	
	12 (46.1)	7(26.9)	7 (26.9)	

of study population had normal Vit D levels, with half of all cohort being deficient in Vit D, and over half of remaining had insufficient levels. The cohort did not show any significant association with any demographic feature or comorbidity.

Certain important aspects of the study needs highlights. Firstly, the prevalence of Vitamin D deficiency in our cohort lies lower than levels reported in local literature reporting general population. Jadoon et al. reported deficiency in 63%, insufficiency in 14.9% and normal levels of Vit D in 22% of General population (vs 49%, 30%, and 20% in our cohort respectively[10]. Similarly, Riaz et al. concluded similar rates of Vit D deficiency (53%), insufficiency (31%) and Normal values (15%) in their cross-sectional analysis of over 4000 patients[11]. The prevalence of normal Vit D cases in all these local studies fall below 20%. Despite selection of only STEMI population, the concordant results of current study with these local studies raise the possibility of Vit D deficiency to be multifactorial at least.

Comparing the study with regional and global studies, similar prevalence of deficiency was found when compared with cohorts from Iran. Hovesepain et al. concluded around 50% population from an Urban Irani center suffering from Vit D deficiency, concordant to our findings[12]. They however concluded a significant association of both gender and younger age with Vit D deficiency. The difference in the body coverings of Women in Iran and Pakistan can be one of contributing factor in decreased sun exposure. In addition, increased prescription of Vit D in elderly population can also be given credit of decreased levels in younger population. Suryanarayana et al. from another neighbouring country also reported concordant findings of 56.3% prevalence of Vit D deficiency, a slightly higher value thanour cohort[13]. Their cohort did show significant association with hypertension, a comorbid that run side by side with ischemic heart disease.

Our study in highlighted an important aspect of Vit D deficiency; association with ischemic heart disease. Our findings have been previously replicated in number of studies. Multiple researchers, including Grimes et al, Douglas et al, and Rostand, related increased incidets of ischemic heart disease attributed to winter weather, and distance from the equator, both strong indicators of Vit D deficiency, highlighting the protective role of Vit D in IHD[14,15,16]. Safaie et al, from a neighboring country concluded significant association of Vit D deficiency with not only ischemic heart disease, but specifically with ST elevation Mi[17]. Vit D deficiency is not only a risk factor for occurrence of Ischemic heart disease, but also a poor prognostic factor for the outcomes of IHD, as proposed by De Metrio et al, who found Vit D deficiency to be an independent risk factor of worse outcomes at 1 year follow up[18]. Similarly, Ng LL et al proposed Vit D deficiency to be independent risk factor for cardiac events including IHD[19].

The First National Health and Nutritional Examination Surveys (NHANES) conducted between 1988-94, and then between 2000-04, both showed a higher prevalence of angina, myocardial infarction, and heart failures in cases with Vit D deficiency as compared to those without Vit D deficiency[20]. Several other prospective cohort studies reported an increased risk of adverse cardiac events including MI in cases of Vit D Deficiency, including one offspring cohort of Framingham study[21,22,23]. Besides, a meta analysis has reported at least 8% decrease in cardiovascular mortality with Vit D replacement[24].

Another important aspect of concern is absence of association of Vit D with the Gender, Diabetes and smoking. Multiple studies has reported a strong association of Gender with Vit D deficiency including Sanghera et al[25]. A non-significant association in our cohort can be attributed to confounding factors due to ischemic heart disease, for which, both smoking and DM were risk factors.

Limitations:

Our study has certain limitation, including, a single centre, cross sectional study with no control group for comparison. We did not include other comorbid conditions as a risk factors, and as confounders such as kidney disease, hypertension, and metabolic syndrome, which are risk factors for both the conditions. such as metabolic panel.

Recommendations:

We strongly recommend to conduct further prospective, multicenter, longitudinal case control studies, to evaluate the effect of Vitamin D deficiency on out-

comes of Ischemic heart disease. Electronic and print media should be engaged to highlight the hazardous effects of vitamin D deficiency on health and awareness campaign/seminars/symposia should be arranged and word must spread among General practioners and junior doctors regarding Vitamin D deficiency and its effects on heart problems.

Conclusion:

Vitamin D deficiency is present in over half of the patients presenting with acute MI, along with another quarter suffering from insufficiency of Vit D. Early screening and treatment of this deficiency in these high-risk patients will not only improve their musculoskeletal symptoms but also improve the cardiovascular outcome through its proposed anti-inflammatory role.

Ethical Approval: Given

Conflict of Interest: The authors declare no conflict of interest.

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