Original Article

Frequency of Vitamin D Deficiency in Patients with Atypical Chest Pain in Cardiac Out Patient Department

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ABSTRACT

Objective: To assess the frequency of vitamin D deficiency in patients who present with atypical chest pain in cardiac OPD.

Study Design: Cross Sectional Study

Place and Duration of Study: This study was conducted at the department of Cardialogy, Liaquat National Hospital, Karachi from Dec 2017 to June 2018.

Materials and Methods: Total 305 patients of either gender with age 30 to 70 years had atypical chest pain were included in the study. Demographics and clinical history were taken from patients. Blood sample for vitamin D level was taken and sent to the institutional laboratory and results were collected to assess the outcome i-e frequency of vitamin D deficiency. The confounding variables were tested by strictly following the requirements for inclusion and exclusion.

Results: There were 210 male and 95 female patients. The mean age of study subjects was 49.17±9.73 years. The vitamin D deficiency was observed in 81(26.6%) patients. The vitamin D deficiency was significantly associated with age, sun exposure, economical status, and educational status.

Conclusion: Among patients with asymptomatic chest pain, high proportion of Vitamin D deficiency was observed. It was significantly associated with age, sun exposure, economical status and educational status.

Key Words: Vitamin D, Deficiency, Atypical Chest Pain.

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INTRODUCTION

Conditions ranging from mild and self-limited (e.g. chest wall pain) to extreme (e.g. anxiety disorder) or life-threatening (e.g. dysfunctional angina, aortic dissection, pulmonary embolism) can cause chest pain. Accu-skeletal symptoms (e.g., costochondritis, Tietze syndrome, costosternal syndrome) are the least severe causes of chest pain. Accu-skeletal detection of life-threatening and significant causes of chest pain must be done without over-testing and over-treating patients with less serious causes. A longitudinal study reported 1,212 consecutive adults over 35 years of age who presented with chest pain to a primary care clinic and monitored them for six months to establish the final diagnosis.[1,2]

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Chest pain is a leading cause of outpatient visits and accounts for more than 6 million emergency room visits in the United States.[3,4] Following serious cardiopulmonary conditions, musculoskeletal pain is considered.

Vitamin D is important in bone health, but recent research also points out its essential role in extra skeletal functions, including skeletal muscle growth, immune and cardiopulmonary functions and inflammatory modulation.[5] Although there is debate about what determines deficient or optimum serum levels of 25-OHD, levels below 50 nmol / L (20 ng / mL) lead to increased bone turnover markers and increased parathyroid hormone (PTH) levels.[4,6]

Vitamin D plays an important role in many places throughout the body, including the development and calcification of the bones.[7] Vitamin D is critical for bone and mineral metabolism, and it is established that vitamin D deficiency can cause rickets and osteomalacia.[8] The adult form of rickets, Osteomalacia, may cause diffuse bone pain. Tenderness to the anterior tibia, sternum, and cost ochondral joints that suggest osteomalacia and vitamin D depletion.[4,9] Even though bone biopsy is the gold standard for osteomalacia, it is usually not performed. Bone pain and vitamin D concentrations below 25 nmol / L (10 ng / mL) are

often appropriate for the osteomalacia clinical diagnosis.[4]

There is research performed locally and globally to determine the vitamin D deficiency in patients with atypical chest pain. The current research is designed to determine the actual prevalence of vitamin D deficiency in patients with atypical chest pain in the local population, despite the prevalence observed in these studies. The outcome of this research may be helpful in determining the current severity of vitamin D deficiency in atypical chest pain and may also be helpful for physicians / cardiologists to include vitamin D deficiency as part of the assessment when dealing with patients with atypical chest pain.

MATERIALS AND METHODS

This single center, non-probability consecutive, cross sectional study was conducted from Dec 2017 to June 2018. Study population in the inclusion criteria was either gender with 30 to 70 years of age, who were diagnosed cases of acute coronary syndrome and de novo lesion (> 70% lesion) in a native coronary artery after angiography, in the outpatient clinics and inpatients attending department of Cardiology at Liaquat National Hospital Karachi.

Following approval by Liaquat National Hospital's ethical committee, all qualifying patients meeting the inclusion requirements were notified and detailed procedure information was given, and a written informed consent was obtained from all patients by the principal investigator. Detailed demographics and clinical history were taken from patient by principle investigator. Was advised vitamin D level and then blood sample for vitamin D level were taken by venipuncture by a well-trained senior staff under supervision of primary investigator after that sample was sent to well-equipped laboratory and results were collected and all the data were recorded on a pre designed proforma. The confounding variables were tested by strictly following the requirements for inclusion and exclusion.

Statistical analysis: Patient data were compiled and analyzed through statistical package for Social Sciences (SPSS) Version 21. Frequency and percentage were computed for qualitative variables like gender, economical status, educational status, diabetes mellitus, vitamin D deficiency. Mean±SD were calculated for quantitative variable i.e. age, sun exposure and HbA1c. The stratification was done on gender, age, economical status, educational status, diabetes mellitus and sun exposure, to see the effect of these modifiers on Vitamin D Deficiency using Chi-square test. P≤0.05 was considered as significant.

RESULTS

The research included total patients of either gender between 30 and 70 years of age who had asymptomatic chest pain to assess the prevalence of vitamin D deficiency. SPSS used to measure the descriptive statistics. It posed qualitative variables in terms of frequency and percentages. This described quantitative variables in terms of mean and standard deviations. Stratification was performed to see the impact on outcome of the modifiers. The post-stratification chi square test was applied taken p-value <0.05 as significant.

The results showed that there were 210 male and 95 female patients. (Table-2).

The mean age of study subjects was 49.17±9.73 years, with range of 40(30–70) years. The distribution of age is presented in Graph-1. The descriptive statistics of age is presented in Table-1. The mean sun exposure was 3.78±0.749 hours per day, with range of 3(2–5) hours per day (Table-1).

The mean duration of symptoms was 4.28±0.84 hours, with range of 3(3–6) hours. [Table-1]. The mean HbA1c was 7.25±2.09%, with range of 8.6(4.3–12.9) %. (Table-1)

The results about economic status showed that monthly income of 27.2% patients was <25,000 rupees. 43.9% had monthly income of 25,000–50,000 rupees and it was observed >50,000 rupees in 28.9% patients. (Table-2)

The educational status showed that 7.9% patients were illiterate, 15.4% had education till primary, 30.2% had completed their education till secondary and rest of the 46.6% patients were got education till graduation. (Table-2)

Among total study subjects 211 were found diabetic and 94 were found non diabetic. (Table-2)

The main outcome i.e. vitamin D deficiency was observed in 81(26.6%) patients. (Table-2)

The stratification according to gender, age & sun exposure was done. Post stratification association of outcome was observed with these modifiers using chi square test considered p≤0.05 as significant.

The results showed that vitamin D deficiency was significantly associated with age (p<0.01), sun exposure (p<0.01). while it was not significantly associated with gender (p=0.366). (Table-3)

Table No.1: Descriptive statistics of age, Sun exposure, duration of symptoms, HbA1c level

Statistics	Age (Years)	Sun exposure (hrs/day)	Duration of symptoms (hrs)	HbA1c level (%)
Minimum	30	2	3	4.3
Maximum	70	5	6	12.9
Mean	49.17	3.78	4.28	7.25
Std. Deviation	9.73	0.749	0.84	2.09

Table No.2: Frequency distribution of gender, economical status, educational status, diabetes mellitus, vitamin D deficiency (n=305)

Gender	Frequency(n)	Percentage (%)
Male	210	68.9%
Female	95	31.1%
Total	305	100%
Economical status	Frequency(n)	Percentage (%)
< 25,000 per month	83	27.2%
25,000 – 50,000 per month	134	43.9%
> 50,000 per month	88	28.9%
Total	305	100%
Educational status	Frequency (n)	Percentage (%)
Illiterate	24	7.9%
Primary	47	15.4%
Secondary	92	30.2%
Graduate	142	46.6%
Total	305	100%
Diabetes mellitus	Frequency (n)	Percentage (%)
Yes	211	69.2%
No	94	30.8%
Total	305	100%
Vitamin D deficiency	Frequency (n)	Percentage (%)
Yes	81	26.6%
No	224	73.4%
Total	305	100%

Table No.3: Frequency and association of vitamin D deficiency according to gender, age groups & sun exposure (n=305)

Gender	Vitamin D deficiency		TOTAL	P-Value
	Yes	No		
Male	59	151	210	0.366
Female	22	73	95	
Total	81	224	305	
Age groups	Vitamin D deficiency		TOTAL	P-Value
	Yes	No		
≤ 45 years	46	58	104	0.001
> 45 years	35	166	201	
Total	81	224	305	
Sun exposure	Vitamin D deficiency		TOTAL	P-Value
	Yes	No		
≤ 3 Hrs/day (n=104)	46	58	104	0.001
> 3 Hrs/day (n=201)	35	166	201	
Total	81	224	305	

DISCUSSION

Chest pain is a leading cause of hospital visits and acco unts for over 6 million emergency room visits in the Un ited States.[4] Despite extreme cardiopulmonary disorder, musculoskeletal causes of chest pain, including costoch ondritis, are usually linked to the final diagnosis.[2,3,4]

While there are several reports of osteomalacia and vitamin D deficiency associated with chest pain[4], we are not aware of any literature reports of vitamin D deficiency induced costochondritis[4].

Vitamin D is essential to bone health, and serum 25-OH vitamin D (25-OHD) is predictive for body stores of vitamin D.[10] Circulating 25-hydroxyvitamin D [25(OH)D] is a robust and reliable marker of vitamin D status and has been used by numerous agencies in the establishment of vitamin D dietary requirements and for population surveillance of vitamin D deficiency or inadequacy.[11] Although there is debate about what determines deficient or optimum serum levels of 25-OHD, levels below 50 nmol / L (20 ng / mL) contribute to increased bone turnover markers and increased parathyroid hormone (PTH) levels.[12] Another study concluded that deficient mineralization of the bone was evident in serum 25-OHD patients less than 75 nmol / L (30 ng / mL) but none above that threshold.

Milder types of deficiency of vitamin D can cause a continuum of pain along the sternum and cost chondral junctions similar to racket and osteomalacia patients. Costochondritis remains a poorly described entity but may be a milder, earlier type of osteomalacia associated with higher 25-OHD serum levels.[13] Importantly, the deficiency of osteomalacia and vitamin D may not be considered when a patient has symptoms consistent with costochondritis, as checking for vitamin D deficiency has not been documented in such cases, nor is it standard. An analysis of the literature showed no documented cases of vitamin D-related costochondritis, and only a few case reports of vitamin D-related chest pain.[14]

In our study, the vitamin D deficiency was observed in 81(26.6%) patients. The male representation was more than females and hence the percentage of vitamin D deficiency was more found in males but difference was not significant. Most of the patients were of age less than or equal to 45 years. But in our study, overall more patients were of age >45 years. The vitamin D was also found deficient in patient who had sun exposure less than or equal to 3 hours. Most of the vitamin D deficient patients earning >50,000 per month and were graduates.

1,25(OH)2D regulates the development of renin, one of the most essential hormones for blood pressure regulation. There is also biological evidence that African Americans, who have been shown to be at higher risk of vitamin d deficiency, also have a higher risk of hypertension and cardiovascular disease.[15] A

randomized, placebo-controlled, double-blind clinical trial of 148 elderly women (mean age, 74 years) revealed vitamin D and calcium to be more effective in lowering systolic blood pressure than calcium.[16,17]

While this research indicates that increased vitamin D is associated with lower risk of hypertension, conflicting results have been recorded in some studies. Jorde and Bonaa[8,18] recorded no correlation between intake of vitamin D and blood pressure.4 However, as with hypertension, conflicting results indicate that increased vitamin D may be a causative factor or have no role in cardiovascular disease.

1,25(OH)2D acts as an immunomodulatory, reducing the production of cytokines and the proliferation of lymphocytes involving the destruction of insulin-β cells in the pancreas and the development of type 1 diabetes mellitus.[19,20] Moreover, β-islet cells express VDR and respond to 1,25(OH)2D by increasing the production of insulin.

A birth cohort research involving 10,366 children in Finland found that higher dietary supplementation of vitamin D was associated with a decreased risk for type 1 diabetes mellitus. Children who routinely received the required supplementary dose of 2000 IU / d of vitamin D in their first year of life had a prevalence ratio of 0.22 (range, 0.05-0.89) for type 1 diabetes mellitus relative to those who regularly received less than 2000 IU / d.20 Likewise, Stene et al[21] recorded a lower risk of type 1 diabetes mellitus in children of mothers who received cod liver oil throughout pregnancy

HbA1c is believed to be an indicator of average blood glucose levels over the preceding 2 to 3 months and thus a long-term glucose homeostasis marker.[22] Abnormalities that result from changes in insulin secretion and insulin-stimulated glucose uptake in the muscle and fat tissues. In vitro experiments and laboratory animal research indicate potential mechanisms for effects on both insulin production and insulin sensitivity of the active form of vitamin D, i.e. 1,25(OH)2D, as reviewed by Pittas and DawsonHughes.[23]

Patients with type 2 diabetes and increased rates of HbA1c have an elevated risk of cardiovascular disease and overall mortality relative to patients with lower levels of HbA1c.[24]

Sensible exposure to the sun will provide a sufficient quantity of vitamin D3, which is retained in body fat and released in winter when vitamin D3 cannot be produced. Arms and legs exposure for 5 to 30 minutes (depending on time of day, season, latitude and pigmentation of the skin) between 10 a.m. And on 3 p.m. Twice a week, exposure to a minimum erythema dose while wearing a bathing suit is equal to ingestion of approximately 20,000 IU of vitamin D2.[9,25] The skin is highly capable of producing vitamin D3, including in the elderly, to minimize the risk of fracture.[9,26] The majority of tanning beds emit 2 to 6 per cent ultraviolet B radiation and are a recommended source of vitamin D3 when used in moderation.

CONCLUSION

Chest pain is a traditional symptom of presentation and is caused by cardiac and noncardiac disorders. Physicians should identify vitamin D deficiency in patients with chest pain, and elicit any risk factors for deficiency. Costochondritis patients at risk of vitamin D deficiency should be screened with a serum level of 25-OHD and treated if vitamin D deficiency is detected.

In conclusion, among patients with asymptomatic chest pain, high proportion of Vitamin D deficiency was observed. It was significantly associated with age, sun exposure, economical status and educational status. Both male and female can be affected with the deficiency. Sensible sun exposure and the use of supplements are needed to fulfill the body's vitamin D requirement.

Author's Contribution:

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