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Assessment of Vitamin D Status In Patients With Essential Hypertension

Youssef Khalel Ahmad[1], Esam Mohamed El-Ghamry[1], Salwa Tawfik[2], Wael Mohamed Atia[3], Mohammad Mohammad Keder[4], Sameh Ahmad Abd-El Kader[1]

[1]Internal Medicine Department, [2] Internal Medicine, National Research Center, [3]Cardiology Department, [4]Clinical Pathology Department, Faculty of Medicine, Al-Azhar University,

Corresponding author: Sameh Ahmed Abdelkader, **E-Mail:** samehahmed806@yahoo.com, **Mobile:** 01099815248

ABSTRACT

Background: There is close relationship between Vit D deficiency and hypertension. It was found that Vit D is potent inhibitor of Renin Aldosterone Angiotensin System (RAAS) which is the main mechanism responsible for development of hypertension. **Aim of The Work:** To assess the role of vitamin D deficiency in the development of essential hypertension and aggravation of its vascular complications. **Subjects and Methods:** This study was conducted on 80 individuals. Individuals were divided into two groups: Group 1: comprising 60 patients with essential hypertension. Group 2: comprising 20 healthy individuals. All individuals included in the study were submitted to: Complete history and physical examinations to evaluate exclusion criteria. Liver and renal function tests, fasting and PP blood glucose, CBC, lipid profile, serum vitamin D (25hydroxycholecalciferol), serum Ca & Ph. Doppler study on carotid artery to assess vascular complications and Echocardiography to assess ventricular mass was done. **Results:** There was statistically significant decrease (p value <0.05) in vitamin D in patients group in comparison to control group. There was highly statistically significant increase (p value <0.001) in intimal thickness and left ventricular mass in patients with low vitamin D level in comparison to patients with normal vitamin D level. In the patient group, 6 patients (10%) were suffering from vitamin D deficiency while 30 (50%) were suffered from vitamin D insufficiency while 24 (35%) show normal levels of vitamin D. Interestingly, intimal thickness and ventricular mass were significantly higher in patients with essential hypertension with low vitamin D than those with normal vitamin D levels. **Conclusions:** Vitamin D deficiency occurs in the majority of essential hypertension patients and therefore decreased serum vitamin D levels is considered an additional risk factor for cardiovascular morbidity and mortality.

Keywords: Vitamin D Status, Essential Hypertension

INTRODUCTION

Vitamin D is a molecule displaying an important physiological impact. Average human diet is neither rich in vitamin D2 (of plant origin) nor in vitamin D3 (of animal origin). Therefore, humans have to rely on the endogenous production of vitamin D3 in Ultraviolet ß (UVß) exposed skin [(1)]. Exposure of skin to sunlight is the major source of vitamin D for human, which provides approximately 95% of daily requirement [(2)].

The central function of Vitamin D is elevation of plasma calcium and phosphate levels for bone health [(3)]. In addition, there has been an increasing interest over the last few years in the relationship of vitamin D with extra-skeletal diseases [(4)]. Vitamin D deficiency has been found to contribute to various cardiac conditions, such as hypertension, coronary artery disease, stroke and atherosclerosis [(5)].

Hypertension is one of the most important risk factors for cardiovascular disease, which is the major cause of morbidity and mortality worldwide [(6)]. Hypertension is classified as either primary (essential) or secondary hypertension. About 90–95% of cases are categorized as primary hypertension, defined as high blood pressure with no obvious underlying cause [(7)]. The remaining 5–10% of cases are categorized as secondary hypertension, defined as hypertension due to an identifiable cause, such as chronic kidney disease, narrowing of the aorta or kidney arteries, or an endocrine disorder such as excess aldosterone, cortisol or catecholamines[(8)].

Accumulating evidence has indicated that the concentration of 25- hydroxyvitamin D in the blood is inversely associated with blood pressure [(9)].

AIM OF THE WORK

The study was performed to clarify the role of vitamin D in essential hypertension and aggravation of its vascular complication.

SUBJECTS AND METHODS

This study was conducted on 80 subjects of both sexes. This study was conducted at Al-Hussein University Hospital. All subjects were selected from the outpatient clinic and Cardiology Department, Al-Hussein University Hospital over a period from January, 2017 to April, 2018. The patients and subjects were divided into two groups: Group 1 (patients group): comprising 60 individuals have essential hypertension, Group 2 (control group): comprising 20 apparently healthy individuals with age and sex matched. The study was approved by the Ethics Board of Al-Azhar University.

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Exclusion criteria: Diabetic patients, renal impairment, patients with secondary hypertension and chronic liver diseases. Patients under vitamin D or calcium treatments

All patients and controls well subjected to the following: Complete history and physical exam to evaluate exclusion criteria. CBC, liver enzymes and renal function tests (urea and creatnin). Fasting and PP blood glucose, lipid profile (LDL-HDL-triglycerides) and Serum Ca & Ph. Serum vitamin D (25hydroxycholecalciferol), measured by radioimmunoassyes [(10)].

Doppler study on carotid artery to asses vascular complications and Echo cardiography to asses ventricular mass.

Statistical analysis of the results: Data were expressed as Mean ± SD. Differences between groups were tested with tailed-student's t-test for unpaired data. For correlation analysis, Pearson's correlation coefficient was calculated. A value of $P \leq 0.05$ and a value of $r \geq 0.03$ were considered significant.

RESULTS

This study was conducted on 80 subjects conducted in collaboration of the Clinical Pathology and internal medicine Department at Al-Hussein University Hospital, Faculty of Medicine, Al-Azhar University over a period from January, 2017 to April, 2018. The subjects were divided into two groups: **Group 1 (patients group):** comprising 60 individuals have essential hypertension, 32 males and 28 females, there ages ranged from 30-50 years, with Mean 40 ± 8 years. **Group 2 (control group):** comprising 30 apparently healthy individuals with age and sex matched, 12 males and 8 females, there ages ranged from 28-52 years, with Mean 39± 7 years.

Table **(1):** shows highly statistical significant difference **(p-value < 0.001)** between studied groups as regard serum calcium, and serum phosphorous. Table **(2):** shows statistically significant difference between studied groups as regards vitamin D, intimal thickness, ventricular mass and blood pressure. Table **(4)** show highly significant **negative** correlation between **vitamin D** and **(intimal thickness, ventricular mass and diastolic blood pressure)** in **patients** group **(p-value < 0.001) for all and** statistically significant **negative** correlation between **vitamin D** and systolic blood pressure in **patients** group **(p-value > 0.05)**.

In the present study out of 60 patients 6 patients (10%) were suffering from vitamin D deficiency while 30 (50%) were suffered from vitamin D insufficiency while 24 (35%) show normal levels of vitamin D. Interestingly, intimal thickness and ventricular mass were significantly higher in patients with essential hypertension with low vitamin D than those with normal vitamin D levels ($P < 0.01$), table (5).

Table (1): Comparison between studied groups as regard laboratory finding

Variables \ Groups		Patients N = (60)	Control N = (20)	T-test T	T-test p-value
Hb(g/dl)	Mean ± SD	13.4±1.3	13.9 ±1.1	1.5	0.1
Platelet(x10^3/cmm)	Mean ± SD	191.8±53.5	214.1±70.9	1.4	0.1
WBCs(x10^3/cmm)	Mean ± SD	6.3 ±1.6	5.9±1.9	0.9	0.4
AST(U/L)	Mean ± SD	18.8 ±5.02	18.5±4.5	0.3	0.8
ALT(U/L)	Mean ± SD	18.9±4.9	19.7±3.9	0.7	0.5
Creat.(mg/dl)	Mean ± SD	0.7 ±0.2	0.8 ±0.1	0.3	0.7
Urea(mg/dl)	Mean ± SD	24.01 ±8.4	23.6 ±6.7	0.1	0.9
FBS(mg/dl)	Mean ± SD	81.2 ±10.3	80.3 ±9.1	0.3	0.7
Ca(mg/dl)	Mean ± SD	8.6 ±0.9	10.5 ±1.2	6.5	< 0.001*
PH(mg/dl)	Mean ± SD	3.2 ±0.8	3.6 ±0.5	3.08	<0.001*
T.G(mg/dl)	Mean ± SD	130.2±27.6	122.1±33.3	1.09	0.2
LDL(mg/dl)	Mean ± SD	95.5 ±18.2	89.9 ±26.9	1.04	0.3
HDL(mg/dl)	Mean ± SD	44.2 ±11.4	46.3 ±8.05	0.8	0.4

*: p-value < 0.05 is considered significant. **: p-value < 0.001 is considered highly significant.

Table (2): Comparison between studied groups as regard vitamin D, intimal thickness, ventricular Mass and blood pressure (systolic and diastolic).

Variable \ Groups	Patients N = (60)	Control N = (20)	T-test T	T-test p-value
Vit. D (ng/ml)	24.1±16.3	39.8±11.1	3.4	<0.001**
Intimal thickness; ml	0.7±0.2	0.4±0.1	8.5	< 0.001**
Ventricular mass; gram	124.1±26.9	89.7±19.9	5.2	< 0.001**
Systolic BP; mmHg	171.2±15.2	110.1±9.7	16.8	< 0.001**
Diastolic BP; mmHg	109.7±16.4	76.9±7.5	8.6	< 0.001**

*: p-value < 0.05 is considered significant. **: p-value < 0.001 is considered highly significant.

Table (3): Rages of serum vitamin D levels [(11)].

Serum levels of vitamin D (ng/ml)	Vitamin D status
<10	Deficiency
10-30	Insufficiency
>30	Sufficiency
>100	Toxicity

Table (4): Correlation study between serum vitamin D and (intimal thickness, ventricular Mass and blood pressure) in patients group.

Items	Significancy (r)	Significancy p-value
Intimal thickness; ml	- 0.5	< 0.001**
Ventricular mass; gram	- 0.4	< 0.001**
Systolic blood pressure; mmHg	- 0.3	<0.006*
Diastolic blood pressure; mmHg	- 0.7	< 0.001**

Table (5): Comparison between intimal thickness and ventricular mass in hypertensive patients with and without vitamin D deficiency.

Variable \ Groups		Patients with low vit. D < 30ng/ml N = (36)	Patients with normal vit. D > 30ng/ml N = (24)	T-test	
				T	p-value
intimal thickness; ml	Mean ± SD	0.8±0.1	0.6 ±0.1	7.2	< 0.01**
ventricular mass; gram	Mean ± SD	131.8±33.5	104.1±30.9	6.7	< 0.01**

DISCUSSION

Hypertension is one of the most common worldwide diseases affecting human that causes significant morbidity and mortality worldwide [(12)].

It is estimated that about 1 billion people worldwide are suffering from some degrees of vitamin D deficiency [(4)].

The present study was performed to determine whether the low level of vitamin D aggravates the essential hypertension and its vascular complications or not. In the present study serum vitamin D, was statistically significantly lower (p value <0.05) in hypertensive patients group than in control group.

The results of this study were matched with the study of ***Alpsoy et al.*** which included 53 normotensive (NT), 42 white c oat hypertension (WCHT) and 59 sustained hypertension (SHT) patients were recruited in this study. The participants were matched for age, sex, and BMI. Plasma vitamin D levels were significantly lower in SHT than in the WCHT and NT groups (26.4±4.9, 34.3±3.6, and 36±5 ng/ml, respectively) [(13)].

There is indication that the existence of a significant inverse association of baseline circulating levels of 25(OH) D with risk of incident hypertension in apparently healthy populations [(14)].

Moreover, it was reported that there is an association of vitamin D deficiency with increased renin-angiotensin-aldosterone system activity among patients with hypertension in India. All the three blood pressure parameters [Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Mean Arterial Pressure (MAP)] were significantly higher among individuals with lower 25(OH)D levels. Mean SBP was 162.4 ± 20.2 mm/Hg and mean DBP was 100.2 ± 11.2 mm/Hg [(15)].

On the other hand, it was reported that cross-sectional studies on the inverse association of 25 (OH) D levels with blood pressure have not been confirmed [(16)]. Moreover, it was reported that there is no association between 25-hydroxy vitamin D levels and blood pressure [(17)]. Also, it was reported that there is no difference in 25 hydroxyvitamin D levels among hypertensive patients versus controls [(18)].

In our study also there was highly statistically significant increase (p value <0.001) in intimal thickness and left ventricular mass in patients with low vitamin D level in comparison to patients with normal vitamin D level.

In the present study out of 60 patients 6 patients (10%) were suffering from vitamin D deficiency while 30 (50%) were suffered from vitamin D insufficiency while 24 (35%) show normal levels of vitamin D. Interestingly, intimal thickness and ventricular mass were significantly higher in patients with essential hypertension with low vitamin D than those with normal vitamin D levels

In a paper published from Turkey, no relation was detected between vitamin D level and plaque type or IMT in hypertensive patients. But vitamin D levels were much higher than ours [(19)].

In another study an inverse relation was found between vitamin D level and IMT in hypertensive subjects. The modest but significant effect of vitamin D on systolic blood pressure was mediated by increased intima media thickness and endothelial dysfunction [(20)].

Another study revealed that the subjects with vitamin D deficiency, when defined as serum 25(OH)D< 20 ng/mL, were 6.5 times more likely to suffer from CHD than the subjects with adequate vitamin D status (serum 25(OH)D ≥ 20 ng/mL), [(1)].

Several studies conducted in developed countries have also demonstrated similar results. For example, an inverse association between vitamin D deficiency and myocardial infarction (MI) was reported among adults in New Zealand [(21)]. In the United States, an NHANES study stated that the participants with vitamin D deficiency had a higher prevalence of angina and MI compared to that in the participants with adequate levels of vitamin D (OR: 1.20 (95% CI: 1.01, 1.36) [(22)].

A study among an Indian population showed 4.5 times higher risk of MI among subjects with vitamin D deficiency (<10 ng/mL) [23]. More recently, in a Gulf country, Qatar, a study indicated that males with vitamin D deficiency had a three times higher risk of MI than males with an adequate vitamin D levels [24].

In conclusions: In the present study there is a strong inverse relationship between serum vitamin D and essential hypertension. Vitamin D deficiency occurs in the majority of essential hypertension patients and therefore decreased serum vitamin D levels are considered an additional risk factor for cardiovascular morbidity and mortality.

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