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CORRELATIVE STUDY OF SERUM VITAMIN D AND ESSENTIAL HYPERTENSION

General Medicine

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ABSTRACT

Background: Most of the musclo skeletal disorders are associated with vitamin D deficiency. It is also observed that vitamin D deficiency is associated with pathogenesis of cardiovascular diseases and arterial hypertension (HTN). **Method:** 300 adult hypertensives were compared with the same number of controlled (normotensive) group. ECG, echo, and relevant blood tests; CBC, LFT, RFT, fasting, and post-prandial blood glucose, lipid profile and serum vitamin D were done. Vitamin D was determined using radio-immune assays. **Results:** Vitamin D levels were observed as deficient in 138 (46%), insufficient in 102 (34%) and normal in 60 (20%) in hypertensive group as compared to deficient in 30 (10%), insufficient in 96 (32%) and normal in 174 (58%) in normotensive group. Mean value was 22.33 (± 3.23) in hypertensive group and 30.31 (± 6.82) in normotensive group. The t test was 36.8 and p<0.001 (p value was significant). **Conclusion:** In the present correlative study, it is confirmed that there is a strong relationship between serum vitamin D deficiency and hypertension. Hence, serum vitamin D levels can be considered as an additional risk factor for cardiovascular morbidity and mortality.

KEYWORDS

Vitamin D, vitamin D deficiency, Hypertension

INTRODUCTION

Vitamin D was termed "D" because it is the fourth vitamin known; the chief source of vitamin D is endogenous. For synthesis of vitamin D in the skin, ultra violet B spectrum of light is required to induce the conversion of the precursor 7 dehydrocholestrol to vitamin D [(1)]. Approximately 80-90 vitamin D is derived from sunlight, whereas only minor amounts of vitamin D come from dietary sources. Fish oil, egg yolk, and mushrooms are rich in vitamin D [(2)].

Vitamin D deficiency is very common in underdeveloped countries like India. Many of the musculo skeletal disorders are associated with vitamin D deficiency. Hypovitaminosis D is an independent risk factor for total mortality [(3)]. It is also observed that vitamin D deficiency is involved in the pathogenesis of cardiovascular diseases and arterial hypertension [(4)]. Hence, an attempt is made to evaluate the level of vitamin D in adult hypertensive adults and correlate it with normotensive adults.

MATERIALS AND METHOD

300 adults with essential hypertension visiting the OPD of Department of General Medicine at Mamata Academy of Medical Sciences & Hospital, Bachupally, Hyderabad, Telangana were studied.

Inclusion Criteria:

1. Adults with essential hypertension
2. Age between 35 to 75 years.
3. Participants giving written consent of approval for inclusion in study

Exclusion Criteria:

Adults with secondary hypertension, pregnant women, adults on calcium or vitamin D supplements, adults on long-term diets and adults suffering from hepatic/GIT/skeletal/endocrinal/diabetes/renal diseases.

Method

300 adults with essential hypertension (study group/hypertensive group) were compared with 300 adults with no hypertension (controlled group/normotensive group). Every participant underwent a complete medical history, thorough physical examination, electrocardiography, echocardiography, all relevant blood tests (CBC, liver enzymes, renal function tests, fasting and post-prandial blood glucose, lipid profile) and serum vitamin D. Serum vitamin D was determined using radio-immune assay. Vitamin D level of < 20mg/ml was considered as deficiency, 20-30 ng/ml as insufficiency; 31-100 ng/ml as normal; and >100 ng/ml as toxic [(5)].

The duration of the study was May 2022 to June 2024.

Statistical Analysis

All the studied parameters of hypertensive group were compared with the controlled group and classified; a t test was applied statistically. The statistical analysis was carried out in SPSS software.

Observations and Results

1. Baseline Characteristics

Highest number of participants were in the age group of 51-60years, 114 in hypertensive group and 102 in the normotensive group. The mean BMI in the hypertensive group was 27.21 (± 3.44) as compared to 26.32 (± 4.76) in the normotensive group. The t test was 2.62 with p value of <0.001. The mean SBP in the hypertensive group was 167.33 (± 18.61) as compared to 116 (±13.40) in the normotensive group. The t test was 38.7 with p value of <0.001. The mean DBP in the hypertensive group was 97.62 (±9.23 as compared to 75.63(±8.30) in the normotensive group. The t test was 30.5 with p value of <0.001.

Table – 1 Comparison Of Base Line Characteristics Between Two Groups

Age group (years)	Hypertensive (300)	Normotensive (300)	t test	p value
< 40	18	12	--	--
41-50	30	48	--	--
51-60	114	102	--	--
61-70	36	24	--	--
BMI	27.21 (± 3.44)	26.32 (± 4.76)	2.62	P<0.001
SBP	167.33 (± 18.61)	116 (±13.40)	38.7	P<0.06
DBP	97.62 (±9.23)	75.63(±8.30)	30.5	P<0.001

2. Electrocardiography (ECG) Findings

- Left atrial Deviation (LAD) was found in 186 adults in hypertensive group as compared to 36 in the normotensive group. The t test was 580.9 with a p value of <0.001.
- Left Ventricular Hypertrophy (LVH) was found in 150 adults in hypertensive group as compared to 12 in the normotensive group. The t test was 755.1 with a p value of <0.001.
- The ECG findings were within normal limits (WNL) in 114 adults in hypertensive group as compared to 264 in the normotensive group. The t test was 445 with a p value of <0.001.

Table 2 Comparison Of ECG Findings Between Two Groups

ECG Finding	Hypertensive (300)	Normotensive (300)	t test	p value
LAD	186	36	580.9	P<0.001
LVH	150	12	755.1	P<0.001
WNL	114	264	445	P<0.001

3. 2-D Echocardiography (2-D Echo) Findings

- Mean Intimal thickness was 0.80mm (± 0.05) in hypertensive group as compared to 0.45mm (±0.06) in the normotensive group. The t test was 77.6 with a p value of <0.001.
- Mean Ventricular mass was 128.30mg/m2 (±12.30) in hypertensive group as compared to 72.30mg/m2 (±8.73) in the normotensive group. The t test was 64.3 with a p value of <0.001.

Table 3 Comparison Of Echo Findings Between Two Groups

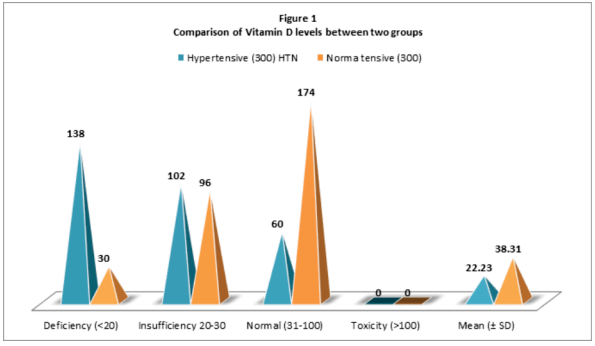
Echo Findings	Hypertensive (300)	Normotensive (300)	t test	p value
Mean Intimal thickness	0.80 (± 0.05)	0.45 (±0.06)	77.6	p<0.001
Mean Ventricular Mass	128.30 (±12.30)	72.30 (±8.73)	64.3	p<0.001

4. Serum Vitamin D Levels

Serum Vitamin D levels were observed as deficient in 138 (46%), insufficient in 102 (34%) and normal in 60 (20%) in hypertensive group as compared to deficient in 30 (10%), insufficient in 96 (32%) and normal in 174 (58%) in normotensive group. Mean value was 22.33 (± 3.23) in hypertensive group and 30.31 (± 6.82) in normotensive group. The t test was 36.8 and p<0.001 (p value was significant).

Table 4 Comparison of Vitamin D Levels Between Two Groups

Vitamin D level (ng/ml)	Hypertensive (300)	Normotensive (300)	t test	p value
Deficiency (<20)	138 (46%)	30 (10%)	--	--
Insufficiency 20-30	102 (34%)	96 (32%)	--	--
Normal (31-100)	60 (20%)	174 (58%)	--	--
Toxicity (>100)	00	00	--	--
Mean (± SD)	22.23 (± 3.26)	38.31 (± 6.82)	36.8	P<0.001



DISCUSSION

In the present study BMI, SBP, DBP, ECG and 2D-Echo findings are highly significant (p value <0.001) in hypertensive group when compared to normotensive group. Serum Vitamin D levels were observed as deficient in 138 (46%), insufficient in 102 (34%) and normal in 60 (20%) in hypertensive group as compared to deficient in 30 (10%), insufficient in 96 (32%) and normal in 174 (58%) in normotensive group. Mean value was 22.33 (± 3.23) in hypertensive group and 30.31 (± 6.82) in normotensive group. The t test was 36.8 and p<0.001. The p value was highly significant. These findings are more or less in agreement with previous studies [6][7][8].

The direct effect of vitamin D upon smooth muscle calcification and proliferation could contribute to their effects on cardiovascular health. Low vitamin levels were also associated with cardiovascular risk factors, including diabetes mellitus (DM), obesity, and hypertriglyceridemia [9]. It is also noted that low vitamin D was associated with myocardial infarction, coronary heart diseases, and heart failure.

It is hypothesized that vitamin D deficiency increases blood pressure through the reninangiotensis system. In lower animals, it is demonstrated that vitamin D receptor null (VDR-null) mice have a several-fold increase in rennin expression and plasma angiotensin-II production, which leads to hypertension and cardiac hypertrophy and increases intake of water. It is also revealed that vitamin D-deficient male rats have increased systolic blood pressure. It is due to changes in 51 cardiac gene expressions, which are important in the regulation of oxidative stress and myocardial hypertrophy. It is also found that adults with vitamin D deficiency have arterial stiffness, endothelial dysfunction, and hyperthyroidism [10]. Older adults are at increased risk for vitamin D deficiency, largely due to reduced vitamin D intake and decreased cutaneous synthesis. It is correlated to increased cardio-vascular diseases due to vascular endothelial dysfunction, as indicated by decreased peripheral arterial dependent dilatation [11].

Summary and Conclusion

The present correlative study has found that serum vitamin D levels are considerably reduced in essential hypertensive adults as compared to normotensive adults, confirming a strong relationship between serum vitamin D deficiency and hypertension. Hence, serum vitamin D levels can be considered as an additional risk factor for cardiovascular morbidity and mortality.

- This research work was approved by Ethical committee of Mamata Academy of Medical Sciences & Hospital, Bachupally-500090, Hyderabad Telangana.
- No Conflict of Interest
- Study was self-funded

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