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Study of Vitamin D_3 Profile in Essential Hypertension

Authors
Shivani Bansal[1], Virendra Verma[2]
[1]Associate Professor, Department of General Medicine, Santosh Medical College & Hospitals, Ghaziabad, Uttar Pradesh
[2]Senior Resident, Department of Medicine, King George Medical University, Lucknow
Corresponding Author
Dr Shivani Bansal
III-E, 99 Nehru Nagar, Ghaziabad, U.P., India
Email: *drshivani2015@gmail.com*, Mobile number 9013451039, landline number 0120-2796111

Introduction

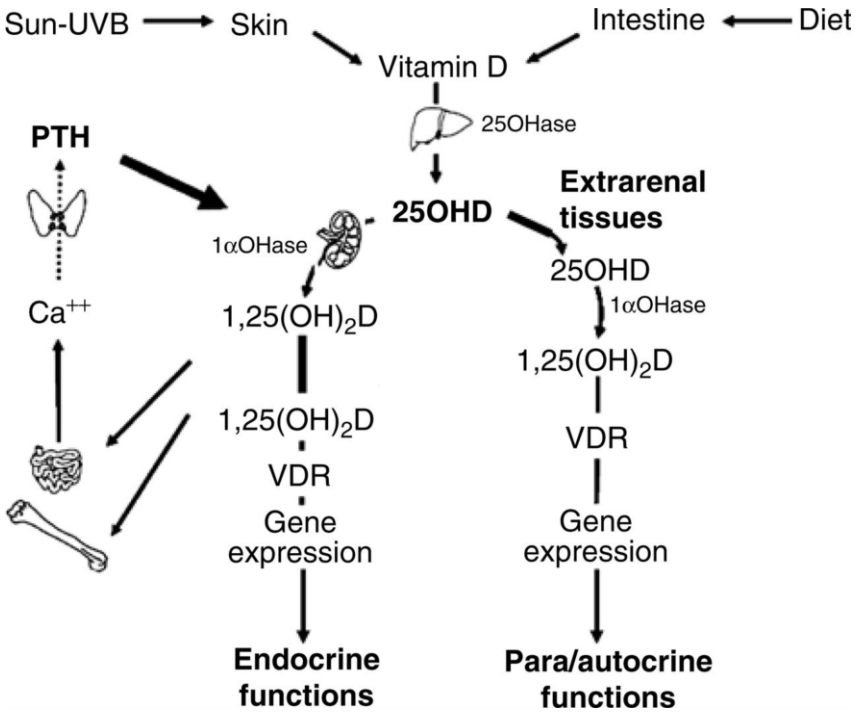
Hypertension is the most common of the cardiovascular diseases, which is theleading cause of morbidity and mortality in the industrial world as well as becoming an increasing common disease in the developing countries. Hypertension is a major risk factor for renal, cerebrovascular and cardiovascular diseases. Therefore it is the most pressing health problems in the world. Hypertension is called the "silent killer" because it often has no warning signs or symptoms[1]. HTN is the most prevalent primary diagnosis reported in ambulatory care visits and its management accounts for 30% of office visits for individuals aged 45 to 65 years and more than 40% among those aged 64 and older[2]. In contrast, controlled blood pressure levels are associated with higher probability of survival rate until age 85 years and also increased longevity without co-morbidities[1]. However, despite advances in medical treatment and public campaigns to reduce the prevalence of hypertension, the disease remains a significant cause of health problems with huge health impacts mainly due to limited knowledge of risk factors related to the condition.

Another pandemic is Vitamin D insufficiency. Almost 50% of the world population is affected by Vitamin D insufficiency[3]. Vit D has known role in maintaining an adequate level of serum calcium, phosphorus, parathyroid hormone and normal bone metabolism alongwith there is evidence that Vit D has a biological effect more than mineral metabolism[4]. The majority of epidemiological studies have shown that Vit D deficiency is a major risk factor for arterial hypertension and cerebrovascular disease[3].

Vitamin D deficiency may predispose to hypertension *via* elevation of PTH and disturbed calcium homeostasis.[5–7] Furthermore, it has been linked to insulin resistance, systemic inflammation, and regulation of the renin–angiotensin system.[8–10] Many tissues express the vitamin D receptor,[11,13] including the myocardium, endothelium, and macrophages, and it has been proposed that vitamin D also influences cardiovascular health *via* autocrine and paracrine actions (Figure 1).[14] A significant

inverse correlation between blood pressure and pulse and Vit D level in experimental studies support the notion that Vit D exerts antihypertensive effects and has beneficial impact on the overall cerebrovascular risk profile and on stroke outcomes[15-17]. In last ten years , several observation studies have supported the concept that Vit D is involved in the pathogenesis of arterial hypertension [18-19]. Early detection of risk factor before the catastrophic effects of severe atherosclerosis is a major health problem for the general public as well as for the practicing physician

Interestingly, there is a growing body of evidence that shows alink between hypertension and Vit D deficiency. it is important to understand this link and its potential impact on health in the context of current epidemiologic and demographics of HTN and to evaluate treatment plans using Vit D supplements asan adjunct therapy for hypertension.



Material and Methods

The study was done in Santosh Medical College, Santosh University, Ghaziabad on patients who attended the medicine OPD/ IPD. The study was conducted in a time span of one year from January 2015 to January 2016. The study design was case control study. 100 subjects of both genders between 30-70 years of age were taken. 80 subjects who were hypertensive were from the case group and another 20 healthy subjects were from the control group.

Inclusion Criteria for the selection of cases were the follow up cases of essential hypertension whether previously diagnosed or recently diagnosed without complication of hypertension. Systolic blood pressure >140 mm Hg and diastolic >90 mm Hg based on average of two readings or one in case of known hypertensive and on antihypertensive medications.

Exclusion Criteria were the secondary hypertensive patients, previous history of cerebrovascular and cardiovascular events, consuming Vit D supplementation, smokers and alcoholics.

The Control group comprised of 20 normotensive healthy subjects male/female.

The patients in the study were subjected to a complete general medical and physical examination, laboratory investigation which included complete blood count, fasting and post

prandial blood sugar, blood urea, serum creatinine, serum Vitamin D3 level, urine routine and microscopy, thyroid profile, lipid profile and ECG. Serum Vitamin D3 level estimation was done by UNITEST 25-OH Vitamin D ELISA. It has pre-filled ELISA cartridge designed for single determination of one patient sample.The pre-filled ELISA cartridge holds the complete set of reagents. The determination is based on competitive enzyme linked immunosorbent assay (ELISA)

Interpretation of results

Deficiency	<12 ng/ml	30 nmol/l
Insufficiency	12-20 ng/ml	(30-50 nmol/l)
Sufficiency	>20-160 ng/ml	(>50-40 nmol/l)

According to the literature the following ranges are suggested for the classification of Vit D status (Conversion factors: 1 ng/ml=2.5 nmol, 1 nmol/l=0.4ng/ml)

Statistical Analysis: in this study to present standard descriptive statistics mean +_SD was used. Categorial variables were expressed as numbers (n) and percentage (%). The two sided student t test was used to compare the mean of age, systolic and diastolic blood pressure, serum levels of $VitD_3$ and BMI values between males and females. Statistical Analysis were conducted using software SPSS. ANOVA test and student t test used for analysis. Statistical significance was defined as p value less than 5% ($p<0.05$)

Observations and Results

A case control study was conducted with 80 hypertensive patients as cases and 20 normotensive patients as control to see the $VitD_3$ levels in hypertensive patients and to find out the relationship of Vit D_3 levels with grades of hypertension, which took place at Department of Medicine at Santosh Medical College and Hospital, Ghaziabad, Uttar Pradesh

Table 1 Demographic, clinical and biochemical Profile of the hypertensive and non-hypertensive patients

S.N	Variables	Hypertensive patients Mean ± SD	Non-Hypertensive patients Mean ± SD	t-test	P value
1	Age(years)	49 ± 7.64	46.30± 8.96	23.10	.000
2	Body Mass Index(kg/m^2)	26.08± 2.03	22.03±1.00	98.36	.000
3	Systolic BP(mm Hg)	161.33±7.00	118.80±3.96	133.88	.000
4	Diastolic BP(mmHg)	93.32±7.68	77.90±4.27	81.42	.000
5	Vitamin D levels				
I	Deficient(<12ng/ml)	8.39±.57	-	64.74	.000
II	Insufficient(12-20ng/ml)	15.68±1.37	-	78.85	.000
III	Sufficient(20-160 ng/ml)	24.37±1.42	36.84±7.54	21.82	.000

Table 6 BMI and Vitamin D_3 level of hypertensive and non hypertensive patients

Variable	N	Hypertensive	N	Non Hypertensive	p-value	Significant
BMI	80	26.08±2.03	20	22.03±1.00	.000	S
Vitamin D_3level						
Deficient	20	8.39±0.57	0	-	.000	S
Insufficient	48	15.68±1.37	0	-	.000	S
Sufficient	12	24.45±1.54	20	36.79±7.62	.000	S

Table 8 correlation between blood pressure and BMI (kg/m^2)

		Mean Blood Pressure	
	Pearson Correlation	Hypertensive 0.112	Non-Hypertensive 0.222
BMI	Sig	0.322	0.933
	N	80	20

Indicates correlation between mean blood pressure and body mass index (kg/m^2) the results shows positive correlation between mean blood pressure and body mass index that is if body mass index increases the mean blood pressure also increases, our results were found significantly non significant (P= > 0.05)

Table 9 correlation between mean blood Pressure and Vitamin D_3 level

Vitamin D3 level		Mean Blood Pressure	
		Hypertensive	Non-Hypertensive
Deficient	Pearson Correlation	0.009	-
	Sig	0.971	-
	N	20	-
Insufficient	Pearson Correlation	-0.117	-
	Sig	0.427	-
	N	48	-
Sufficient	Pearson Correlation	0.254	0.08
	Sig	0.426	0.73
	N	12	20

Discussion

Vitamin D deficiency has been proposed as an associating factor with increased blood pressure. According to various epidemiological studies it is estimated that more than 1 billion people worldwide could have arterial hypertension. Hypertension is a major risk factor for renal, cerebrovascular and cardio vascular diseases. Similarly Vit D deficiency is a well known risk factor for osteoporosis has also been presented as an influential factor in the metabolic diseases and cardiovascular system diseases particularly hypertension[20] .The coexistence of two diseases associated with severe outcomes.

A case control study was conducted which was restricted to 80 hypertensive cases and 20 normotensive controls to study the Vitamin D_3levels in hypertension and to find out relationship with grades of hypertension. Patients were evaluated with detailed history, meticulous examination and laboratory investigations. In our study we found 68% of the participants suffered from Vit D deficiency and 32% were found with sufficient Vitamin D levels. Serum Vitamin D_3 levels were found on lower side in hypertensive patients in comparison to non hypertensive patients, hypertensive 24.37± 1.42 and non hypertensive 36.84±7.54 (Pvaiue .000 significant)

Similar results were found by Liyc, Kongj et al 2002 and Mac Greger GA et al 1993[21,22] Gaganvelayudhan, Sasidharan PK found lower Vitamin D levels in both cases and controls[2]

In our study we also found that maximum number of hypertensive patients in 5th decade of life and minimum number of hypertensive were found in 3rd decade of life . In our study we also found males are more prone for hypertensive disorder and vitamin D deficiency (n=42). The results of our study are similar to study Akbar Yousfini et al 2016[24]. They demonstrated older age group patients, males are more prone for hypovitaminosis D in comparison to females. Similar results were found by Adams JS et al[25]. The reason for that as old age people are having more indoor activity as compared to younger ones so reduced exposure to sunlight leading to low Vitamin D_3 levels.

The findings of our study also revealed that a significant increase in BMI in hypertensive cases 26.08±2.03 as compared to controls 22.03±1.00(P value .000). Our findings corroborates with Fatemeh Ardeshirlarjani et al 2013[26], who analyzed cross sectional data revealed the important effect of the interaction between BMI and Vitamin D on systolic blood pressure levels in adjusted model.

In our study inverse correlation was seen for Vitamin D_3 levels in hypertensive cases. Vitamin D_3 levels deficiency were found in hypertensive patients in comparison to normotensive controls it was significant P=.000. The results of our study are similar

Conclusion

This study concludes that the prevalence of vitamin D deficiency is increasing at a rapid rate in developing as well as developed countries. Vitamin D deficiency prevails in epidemic proportion all over Indian subcontinent with a prevalence of 70-10% in general population. This

is concluded that Vitamin D level screening among hypertensive patients is important marker for decreasing the complications and also reduces mortality rates and morbidity. More so in our study, the inverse correlation exists between Vitamin D_3 levels and mean systolic and diastolic blood pressure, it indicates that if Vitamin D_3 levels decrease, blood pressure increases and person becomes more prone for hypertensive disease

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