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Effect of Vitamin D Supplementation in Systemic Hypertension in Tertiary Care Teaching Hospital, Navi-Mumbai

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Dr. Vaishali Thakare*, Dr. P. Yadav, Dr. Lily Dubey

Dr. D. Y. Patil Medical College, Nerul, Navi-Mumbai

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ABSTRACT

Introduction: There is a growing body of evidence that shows a link between hypertension and vitamin D deficiency. Vitamin D is said to have several pleiotropic actions, including a strong influence on cardiovascular system. Blood pressure (BP), lipid profile, glycemic pattern, inflammatory state and cardio-metabolic risk are inversely associated with plasma vitamin D values. Studies suggest that low vitamin D levels are associated with a higher risk of hypertension but randomized controlled trials showed mixed effects of vitamin D supplementation on blood pressure (BP). Material and methods: The study was conducted in the tertiary care teaching hospital, in outpatient Department of General Medicine in 104, hypertensive subjects with vitamin D deficiency. The patients received both anti-hypertensive as well as Vitamin D supplementation i.e. Vitamin D3 - 60,000 IU once a week for 6 week in the morning. Results: The present study noted a statistically significant fall in systolic blood pressure in group 2 from 142.6± 1.92 to 139.1 ± 2.1*($p<0.05$). Group 2 patients showed an insignificant fall in diastolic blood pressure from 82.5± 2.6 to 81.0 ± 2.9. Conclusion: From the above study it is clear that Vitamin D supplementation has a role in the regulation of blood pressure.

INTRODUCTION

Hypertension, also known as high blood pressure, is a major modifiable risk factor for heart disease and stroke. Elevated blood pressure is an independent risk factor for coronary heart disease, stroke, congestive heart failure, and chronic renal disease. It is associated with high mortality rate, accounting for an estimated 14% of cardiovascular deaths worldwide and 18% of deaths in high income countries (Vitamin D and hypertension). 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. Hypertension has many etiological factors, which include age, race, family history, obesity, sedentary lifestyle, using tobacco, high salt intake, stress, and consumption of alcohol in a larger quantity (1). Interestingly, there is a growing body of evidence that shows a link between hypertension and vitamin D deficiency. Vitamin D is known for its role on the bone and calcium-phosphorus metabolism, but in the last years, a rising number of observations have highlighted several pleiotropic actions, including a strong influence on cardiovascular system (2,3). Blood pressure (BP), lipid profile, glycemic pattern, inflammatory state and cardio-metabolic risk are inversely associated with plasma vitamin D values (4-10). Observational studies suggest that low vitamin D levels are associated with a higher risk of hypertension but randomized controlled trials showed mixed effects of vitamin D supplementation on blood pressure (BP). If vitamin D supplementation lowers blood pressure, its widespread use could have major public health benefits. Hence we aim to evaluate whether vitamin D supplementation is effective to reduce blood pressure in hypertensive patients.

Aims and objectives

To study the effect of Vitamin D3 Supplementation on Blood pressure in Hypertensive subjects.

MATERIAL AND METHODOLOGY

The study was conducted in the tertiary care teaching hospital, in outpatient Department of General Medicine.

Study period –

This study was conducted from for a period of 1 year, after getting clearance from the Institutional ethics committee.

Sample size –

104 hypertensive subjects with vitamin D deficiency were enrolled in the study after taking an informed consent.

Inclusion criteria

Patients of either sex between 30-70 years with hypertension (SBP<170mm of Hg and Diastolic <110 mm of Hg) with vitamin D deficiency together (<20nmol/L) willing to give informed consent.

Exclusion criteria

Patients with other comorbid conditions like Diabetes Mellitus, hepatic or renal disease, hyperparathyroidism and hypercalcaemia, previously taken any form of vitamin supplementation, bisphosphonates or hormone replacement therapy and history of smoking, alcoholism or tobacco use were excluded from the study.

Study Design

Enrolled patients were randomized in two groups.

Group 1:

Included 50 patients who have received antihypertensive treatment only.

Group 2:

Included 54 patients who have received both Anti-hypertensive as well as Vitamin D supplementation i.e. Vitamin D3 - 60,000 IU once a week for 6 weeks in the morning

Following baseline investigations were done.

- Routine Complete blood count

- Renal function test - serum : serum Creatinine & Serum Urea
- Serum Vitamin D3. - Baseline and after 6 weeks in method
- Liver function test
- Complete general examination & blood pressure measurement

Blood sample collection

The samples were taken between 06:00 am and 10:00 am after a 12‑h fasting. Serum 25OHD3 and 1,25-(OH)2 D3 were measured by RIA.

Blood pressure measurement-

Regular follow up for blood pressure measurement was done in Outpatient department every week. The blood pressure recordings were done by the same physician in all subjects.

Blood pressure was measured after at least 5 min of rest in a quiet room using a mercury sphygmomanometer with an appropriate cuff. Systolic and diastolic blood pressures were taken at Korotkov sounds I and V.

Statistical Analysis

The statistical analysis was done using SPSS version 16.0 statistical analysis software. The values were represented in number (%) and mean ± standard deviation. Student's t‑test was used to test the significance of two means. For all cases, in which a statistical test was conducted, a $P < 0.05$ was considered to indicate a significant difference.

RESULT

The results are depicted in the following tables

Table -1 Gender wise distribution of study population

Sex	Percentage of patients (N)
Male	59% (62)
Female	41 % (42)

Table -2 Age wise distribution

Age group	Percentage of patients (N)
35 – 45 years	20 % (21)
45-55 years	50 % (52)
55 years onwards	30 %(31)

Table – 3 Criteria for Vitamin D deficiency

Criteria	Blood levels of vitamin D	Percentage of patients (N)
Vitamin D deficiency	<20 ng/mL	88.46 %(92)
Vitamin D insufficiency	20-30 ng/ml	11.54%(12)

Table – 4 Corrected levels of Vitamin D after supplementation

Vitamin D levels	Percentage of patients (N)
20-40ng/mL	81.8(85)
40-50ng/mL	18.2(19)

Table -5 Changes in blood pressure after vitamin D supplementation

Blood pressure	Group 1- (Only antihypertensives) (N=50)		Group 2- (Antihypertensives+ Vitamin D)(N=54)	
Systolic B.P. mmHg	Baseline 141.8±2.2	Post drug 141.3±2.8	Baseline 142.6± 1.92	Post drug 139.1 ± 2.1*(p<0.05)
Diastolic B.P. mmHg	81.6±2.2	81.2 ±2.5	82.5± 2.6	81.0 ± 2.9

*statistically significant

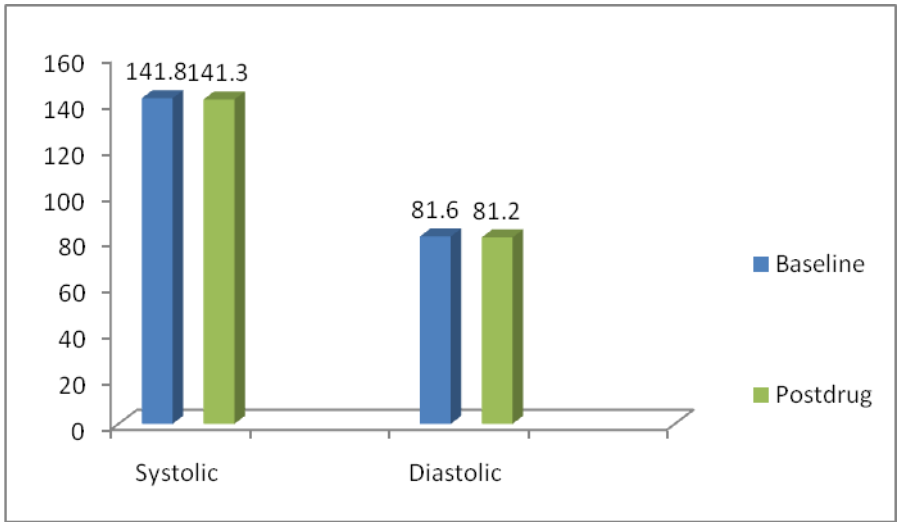

Figure -1 Changes in blood pressure after 6 weeks of treatment in group 1

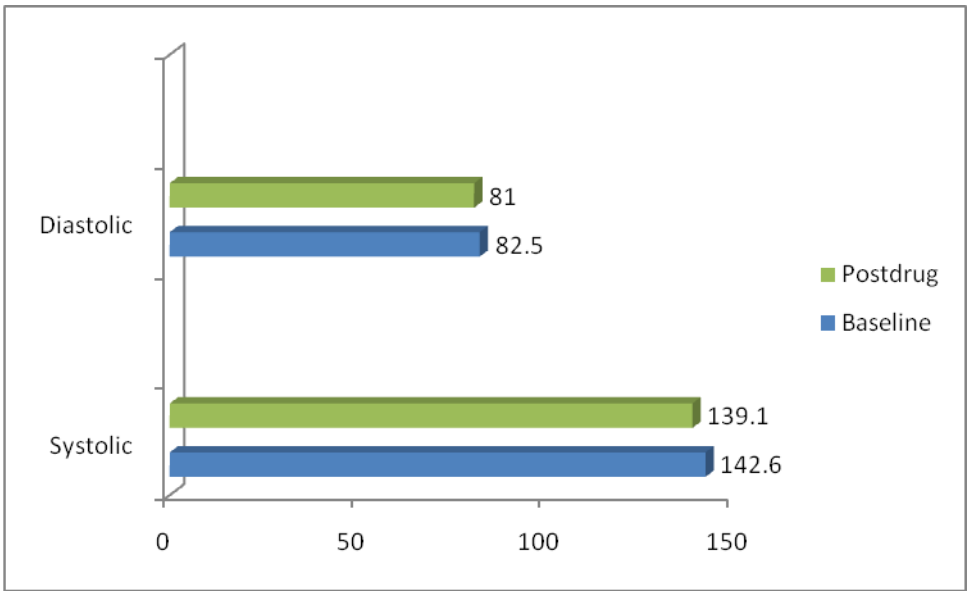

Figure -2: Changes in blood pressure after 6 weeks of treatment in group 2

DISCUSSION

Vitamin D deficiency is an emerging risk factor for multiple co-morbidities worldwide, despite abundant sunshine. So far, various studies have been done to prove an association between Vitamin D deficiency and HTN. This relationship has already been established in the Western population but needs further validation in the Indian scenario. [12‑13]. Though there are conflicting results of vitamin D supplementations on blood pressure. Wu *et al*. performed a meta-analysis from four randomized controlled trials of oral vitamin D supplementation in BP. They found that vitamin D supplementation significantly reduced systolic BP by 2.44

mmHg, but not diastolic BP(14). Witham *et al*. examined eight randomized controlled trials in participants with mean baseline BP >140/90 mmHg, showing a non-significant reduction in systolic BP and a small significant reduction in diastolic BP (3.1 mmHg) (15).

Pittas *et al*.(16) investigated the role of vitamin D or UVB radiation in BP regulation in 10 trials and found no significant effect of vitamin D on BP. However, when limiting their analyses to studies that used higher doses of vitamin D supplementation (at least 1,000 IU/day), they were able to detect a small but statistically significant effect.

Because high blood pressure (BP) has emerged as the leading risk factor for the global disease burden, it is important to evaluate whether vitamin D has a beneficial effect on lowering BP to clarify the potential role of vitamin D for public health (17).Several randomized controlled trials (RCTs) on vitamin D supplementation and BP have already been performed as mentioned above but have shown inconsistent results. Since there is lack of knowledge in this field. We conducted this study to evaluate the role of vitamin D in reduction of blood pressure in hypertensive patients.

The study was conducted in D.Y.Patil university school of Medicine & Hospital, Navi-Mumbai in the outpatient Department of Medicine for a period of 1 year after getting clearance from the Institutional ethics committee. 104 hypertensive subjects with vitamin D deficiency were enrolled in the study after taking an informed consent. The study population was randomly divided I two groups. Group, I consisted of 50 patients who were receiving conventional antihypertensive agents only. While Group II included 54 patients receiving Vitamin D3 60,000IU once a week for 6 weeks along with conventional antihypertensive agents. As shown in Table-1, Demographic data of our study shows that male population was 59% & 41 % belongs to female which is consistent with Priya, *et al*.(18) Vitamin D and hypertension, March 2017.As depicted in Table -2, 20 % study population was from 35 – 45 years while 50 % patients were from Age 45-55 years & 30 % were belonging to 55 on wards group. This could be because of high prevalence of hypertension in late middle age group.Low vitamin D levels have been associated with increased prevalence of systemic hypertension, 2017 Mehta *et al*.(19).We have measured the vitamin D levels at baseline for enrollment of deficient patient in the study & at the end of 6 weeks. The results are as shown in Table 3 & 4 & with this dose, there is correction to the normal level.

Several mechanisms have been proposed to explain blood pressure lowering effects of Vitamin D. As an environmental risk factor, vitamin D deficiency is highly likely to be an important trigger to shift the unstable balance between vasoconstriction and vasodilation signaling in favor of vasoconstriction, leading to HTN in vulnerable middle-aged people. The antihypertensive effect of vitamin include suppression of the RAAS, renoprotective effects including anti-proteinuric and anti-inflammatory effects, direct effects on endothelial cells and calcium metabolism, inhibition of growth of vascular smooth muscle cells & prevention of secondary hyperparathyroidism(20,21,22.).

In accordance with various studies Goel *et.al*, (Systolic blood pressure from 149.1 ± 0.88 to141.6 ± 0.92*,fall by 7.5 mmHg& no change in diastolic blood pressure) Carrara *et al* (Systolic137.4 ± 1.8 , 134.8 ± 2.3,fall by 2.6 & Diastolic from81.6 ± 1.8 to 81± 1.6), Larsen, *et al.* (Systolic B.PDecreased by 7mmHg, Diastolic B.P. Decreased by 2 mmHg) & Pfeiffer and colleagues,2001 (Systolic7.4 mmHg, Diastolic No change).

As shown in Table -5 & Figure 1 & 2, in the present study we have noted a statistically significant fall in systolic blood pressure in group 2 from 142.6± 1.92 to 139.1 ± 2.1*($p<0.05$). There is also an insignificant fall in diastolic blood pressure from 82.5± 2.6 to 81.0 ± 2.9.

CONCLUSION

From the above study, it is clear that Vitamin D supplementation has a role in the regulation of blood pressure and that it should be supplemented with the antihypertensive drugs to the patients with hypertension. However, larger randomized studies are needed to confirm these potential findings.

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