ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
Index Copernicus Value: 68 . 16
PubMed - National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 5, Issue –4, July - 2020, Page No. : 253 - 257

The Role of Vitamin D Status in Patients with Hypertension

[1]Mahesh Kumar, Department of Biochemistry, IMCHRC, Indore, India
[2]BK Agrawal, Department of Biochemistry, IMCHRC, Indore, India
[3]Bhagwan Singh Meena, Department of Biochemistry, IMCHRC, Indore, India
[4]Mahakal Chandel, Academic Registrar, Malwanchal University, Indore, India
Corresponding Author: Bhagwan Singh Meena, Department of Biochemistry, IMCHRC, Indore, India.

Citation this Article: Mahesh Kumar, BK Agrawal, Bhagwan Singh Meena, Mahakal Chandel," The Role of Vitamin D Status in Patients with Hypertension", IJMSIR- July - 2020, Vol – 5, Issue - 4, P. No. 253 – 257.
Type of Publication: Original Research Article
Conflicts of Interest: Nil

Abstract

Background: Hypertension is close related to vitamin D deficiency. It was found that vitamin D is potent inhibitor of RAAS (Renin Aldosterone Angiotensin System) 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 hypertension.

Subjects and Methods: Whole study population included 250 hypertensive cases and 250 controls. All individuals included in the study were submitted to: Complete history and physical examinations to evaluate exclusion criteria. Serum vitamin D (25hydroxycholecalciferol), measured by ELISA. Mean and standard deviation were calculated for serum vitamin D. Statistical analysis was done using SPSS no. 17 and Microsoft excel.

Result: There was statistically higher significant decrease (p value <0.001) in vitamin D in hypertensive cases comparison to control groups. Thickness and ventricular mass were significantly higher in hypertensive patients with low vitamin D.

Conclusion: Vitamin D deficiency occurs in the majority of hypertension patients and therefore decreased serum vitamin D levels is considered an additional risk factor for cardiovascular morbidity and mortality.

Keyword: Vitamin D, Hypertension.

Introduction

Vitamin D is playing an important role in human health and diseases. Vitamin D contains a steroid scaffold and possesses lipophilic properties. About 80–90% is endogenously synthesized and the remaining 10–20% comes from nutritional intake[1]. The inactive vitamin D is found in two distinct forms in the organism, cholecalciferol (D_3) and ergocalciferol (D_2) respectively. These inactive forms must undergo two hydroxylation to become the active form $1,25(OH)_2D_3$. The endogenous synthesis of cholecalciferol is catalyzed by sun-exposure of the skin with UVB radiation[2].

Vitamin D has play main role in calcium metabolism. Vitamin D receptors have been found on various tissues (e.g. vascular smooth muscle cells, rennin producing juxtaglomerular cells, etc.) not directly related to

calcium metabolism[3]. Theorem that Vitamin D may have a more direct role in blood pressure regulation has been substantiated in several epidemiological studies[4,5,6]. Vitamin D deficiency has been found to contribute to various cardiac conditions, such as hypertension, coronary artery disease, stroke and atherosclerosis[7].

Hypertension provides both depression and hope; depression because it is quantitatively the large risk factor for cardiovascular disease (CVD), growing the prevalence, virtually poorly controlled everywhere, and hopes because prevention is possible (though rarely achieved) and treatment can effectively control almost patients, resulting in marked reductions in stroke and heart attack[8]. World Health Report was identified hypertension and its third ranked factor for disability adjusted life years. Hypertension is the most important etiologic in the most of the cardiac and vascular disorders, causing increase in death worldwide. Hypertension is reported to be the fourth contributor to premature death developed countries and developing countries[9,10,11].

Accumulating evidence has indicated that the concentration of vitamin D in the blood is inversely associated with blood pressure[12].

Aim of the work: The study was estimated to clarify the role of vitamin D in hypertension and aggravation of its vascular complication.

Subject and Methods

The present study was carried out 250 persons afflicted with hypertension, and equal number of age and sex matched healthy controls were attending the outpatient department (OPD) of medicine department of Index Medical College and research center, Indore. The study was commenced after obtaining clearance from Institutional Human Ethical Committee. All cases were selected by simple random selection (SRS). Hypertension cases were between the age 20-60 years irrespective of gender and all controls were selected from the neighborhood of cases.

Exclusion Criteria: chronic smoking**,** Obesity, Diabetes mellitus, Dyslipidemia, Gout, Pregnancy, Recent history of infectious disease.

All patients and controls well subjected to the following: Complete history and physical exam to evaluate exclusion criteria. Serum vitamin D (25hydroxycholecalciferol), measured by ELISA.

Statistical analysis of the results: Data were expressed as Mean ± SD. For correlation analysis, Pearson's correlation coefficient was calculated. A value of P <0.001 was considered highly significant.

Results

Statistical analyzes projected that vitamin D of hypertensive patients found to be significantly decreased in Table 1. This was observed that the average (mean ± standard deviation) vitamin D concentration was found in the control group was 33.95 ± 9.41 and in the test group, it was 16.33 ± 3.18. The vitamin D level was found significantly lower comparison to that in the control group, with a p value of < 0.001.

Table 1: Vitamin D in control group (healthy subjects) and test group (hypertension). All the values are mean ± SD.

	Control group	Test group	P value
Vitamin D	33.95±9.41	16.33±3.18	<0.001*

* Highly significant

** Non-significant

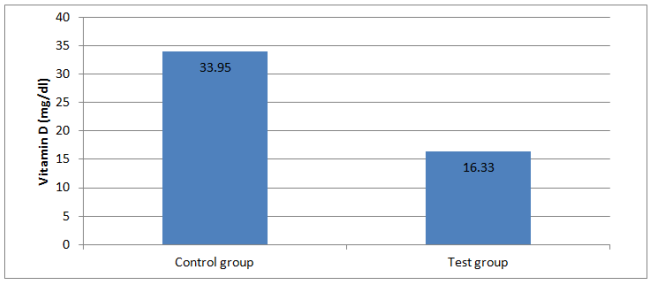

Fig. 1: Vitamin D in control group (healthy subjects) and test group (hypertension).

Discussion

Hypertension is one of the most common worldwide diseases affecting human that causes significant morbidity & mortality worldwide[13]. It is estimated that about 1 billion people worldwide are suffering from some degrees of vitamin D deficiency[14]. The present study was performed to determine whether the low level of vitamin D aggravates hypertension & its vascular complications or not. In the present study serum vitamin D, was statistically significantly lower (p value <0.001) in hypertensive patients group than in control group. 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[15].

Adscititious, it was reported that there is an association of vitamin D deficiency with elevated 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) & Mean Arterial Pressure (MAP)] were significantly higher among individuals with lower 25(OH)D levels. Mean SBP was 162.4 ± 20.2 mm/Hg & mean DBP was 100.2 ± 11.2 mm/Hg [16]. One of the other hand, it was reported that cross-sectional studies on the inverse association of 25 (OH) vitamin D levels with blood pressure have not been confirmed[17]. Moreover, it was reported that there is no association between 25-OH vitamin D levels & blood pressure[18]. Also, it was reported that there is no difference in 25 hydroxyvitamin D levels among hypertensive patients versus controls[19].

In our study also there was highly statistically significant increase (p value <0.001) in intimal thickness & left ventricular mass in patients with low vitamin D level in comparison to patients with normal vitamin D level. 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]. 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 healthy persons in New Zealand[21]. 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, Gulf country, Qatar, a study showed that males with vitamin D deficiency had a three times higher risk of MI than males with an adequate vitamin D levels[24].

Conclusion

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.

Acknowledgment: The authors are thankful to the faculty and staff of department of biochemistry, Index Medical College, Hospital and Research Centre.

References

1. Carsten C. The physiology of vitamin D far more than calcium and bone. Frontiers in physiology.2014; 5: 1- 2.
2. Baeke F, Takiishi T, Korf H, Gysemans C, Mathieu C. Vitamin D: Modulator of the immune system. Curr. Opin. Pharmacol. 2010;10:482–496.
3. Kawashima H. Receptor for 1,25-Dihydroxyvitamin D in vascular smooth cell line derived from rat aorta. Biochem Biophys Res Commun. 1987;146:1-6.
4. Mehta V, Agarwal S. Does Vitamin D Deficiency Lead to Hypertension?. Cureus 2017;9(2):1038.
5. Qi D, Nie X, Wu S, Cai J. Vitamin D and hypertension: Prospective study and meta-analysis. PLOS ONE.2017;12(3):174298
6. Fanari Z, Hammami S, Hammami MB et al. Vitamin D deficiency plays an important role in cardiac disease and affects patient outcome: Still a myth or a fact that needs exploration? J Saudi Heart Assoc 2015;27:264–271.
7. Schneider L, Lutsey PL, and SelvinE. Vitamin D, vitamin D binding protein gene polymorphisms, race and risk of incident stroke: the Atherosclerosis Risk in Communities (ARIC) study. European Journal of Neurology.2015;22: 1220–1227.
8. Kaplan NM, Victor RG, Flynn JT. Hypertension in the population at large. Kaplan's clinical hypertension. 10th Edition. Lippincott Williams & Wilkins Publication; 2010.
9. Anonymous Report of the Joint National Committee. Detection, Evaluation, and Treatment of High Blood Pressure: A cooperative study. JAMA. 1977;237:255–261.
10. Masum QAA, Ahmed MU, Uddin MR. Target organ damage in hypertension in an academic hospital. TAJ. 2008;21(1): 63-68.
11. Deepa R, Shanthirani CS, Pradeepa R. Is the rule of halves in hypertension still valid?-evidence from the Chennai Urban Population Study. J Assoc Physicians India. 2003;51:153-7.
12. Pilz S, Tomaschitz A, Ritz E and Pieber T. Vitamin D status and arterial hypertension. A systematic review, Nat. Rev, Cardiol.2009;6: 621–630.
13. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr,Jones DW, Materson BJ, Oparil S, Wright JT, Roccella EJ (2003): National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, Hypertension, 42:1206-1252.
14. Holick M F, Binkley N C, Bischoff-Ferrari H A, Gordon C M, Hanley D A, and Heaney R (2011): Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab., 96: 1911-1930.
15. Kunutsor SK, Apekey TA, and Steur M (2013): Vitamin D and risk of future hypertension: meta-analysis of 283,537 participants. Eur J Epidemiol., 28:205–221.
16. Kota SK, Jammula S, Meher LK, Panda S, Tripathy PR and Modi KD (2011): Renin-angiotensin system activity in vitamin D deficient, obese individuals with hypertension: An urban Indian study. Indian J Endocrinol Metab., 15:395-401.
17. Guessous I, Bochud M, Bonny O, and Burnier M (2011): Calcium,vitamin D and cardiovascular

disease, Kidney and Blood Pressure Research, 34:404–417.

18. Rueda S, Fernandes C, Romero F, Martinez J, and Vidal J (2008): Vitamin D, PTH and the metabolic syndrome in severely obese subjects. Obes.Surg., 18: 151-154.
19. Reis J, Von Muhien D, Kritz D, Wingard L, and Barrett E (2007): Vitamin D, PTH levels and prevalence of metabolic syndrome in communitydwelling older adults. Diabetes care, 30:1549-1555.
20. Puldowski P, Jaworski M, Niemirska A, Litwin M, Szalecki M, Karcmarewicz E, Michalkiewicz J (2014): Vitamin D status, body composition and hypertensive target organ damage in Relation between carotid intima media thickness and vitamin D in hypertensionprimary hypertension. J Steroid BiochemMolBiol., 144: 180-184.
21. Scragg R, Jackson R, Holdaway I, Lim T, Beaglehole R (1990): Myocardial infarction is inversely associated with plasma 25-hydroxyvitamin D3 levels: A community-based study. Int. J. Epidemsiol., 19: 559–563.
22. Roy A, Lakshmy R, Tarik M, Tandon N, Reddy K, Prabhakaran D (2015): Independent association of severe vitamin D deficiency as a risk of acute myocardial infarction in Indians. Indian Heart J., 67, 27–32.
23. El-Menyar A, Rahil A, Dousa K, Ibrahim W, Ibrahim T, Khalifa R, Rahman M (2016): Low vitamin D and cardiovascular risk factors in males Healthcare, 4: 77 -111.