Association between Serum Level of Vitamin D and Lipid Profiles in Essential Hypertensive Patients at Different Age of Life

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ABSTRACT

Background: It is suggested that vitamin D deficiency is associated with cardiovascular disease (CVD) via its effect on lipid profiles. The objective of this study was to determine the association between serum levels of vitamin- D and lipid profiles in patients with essential hypertension.

Materials and methods: A cross-sectional study was done in the Department of Biochemistry on 200 subjects in the age group of 21-80 years, attended OP Hind Institute of Medical Sciences U.P. Serum 25hydroxyvitamin D levels were estimated by chemiluminescence immunoassay (CLIA) and lipid profiles also (including triglyceride (TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and total cholesterol) were measured. Data collected included age, gender, vitamin D levels, and lipid levels. The chi-square and independent sample t-tests were applied when appropriate, for comparisons between groups to determine significance. A P-value of less than 0.05 was considered statistically significant.

Result: The study included 200 hypertensive patients. Patient ages ranged from 21 to 80 years with a mean age of 56.2 ± 11.8 years. Cholesterol levels were observed to be high among 61 (32.3%) patients. Considering vitamin D, the average level among male patients was 26.526 ng/ml compared to 26 ng/ml% among females (P = 0.742).

Conclusion: The results of present study show that serum concentrations of 25(OH) D were inversely associated with lipid profile. More interventional studies are needed to confirm the relationship between serum concentration of vitamin D and lipid profile in patients with essential hypertension.

Keywords: *Cholesterol, Essential hypertension, blood pressure, Triglycerides, dyslipidemia, lipids*

INTRODUCTION

Essential hypertension is a common chronic non-communicable disease whose prevalence is increasing at an alarming rate worldwide [1]. Essential hypertension is associated with a higher risk of cardiovascular disease, blindness, kidney disease and neurological complications [2,3,4]. The Multicenter Osteoporosis Study in Iran estimated the prevalence of mild, moderate, and severe vitamin D deficiency at 47.2%, 45.7%, and 44%, respectively.Women represented 2% of the age groups <50, 50-60 and â‰¤60 respectively, and 54.2%, 41.2% and 37.5% of men in the same age group. Vitamin D is a fat-soluble vitamin with known functions in bone homeostasis

and metabolism.Research over the past decades has shown that vitamin D deficiency plays an important role in many non-skeletal diseases [5], such as hypertension [6], cardiovascular disease [7,8], diabetes type 1 and type 2 [8] , Diseases of the immune system, osteoporosis and cancer [9]. Vitamin D receptor (VDR) found in various tissues and alpha 1-hydroxylase (converts 25-hydroxyvitamin D (25(OH)D) to 1,25-(OH)2-D, the active form of vitamin D) present locally in [ten]. Numerous cross-sectional and interventional studies have shown that vitamin D deficiency is associated with essential hypertension. Therefore, serum 25(OH)D concentrations are lower in hypertensive patients than in healthy controls. Several mechanisms have been proposed to explain the inverse relationship between vitamin D and essential hypertension. Many researchers have demonstrated that vitamin D plays an important role in endothelial function, blood pressure control, coronary vascular calcification, increased vascular resistance and prevention of cardiovascular disease [11]. The effect of vitamin D on the regulation of lipid profiles is one of the mechanisms underlying the association between vitamin D deficiency and CVD. Complications of dyslipidemia include retinopathy, nephropathy, stroke, myocardial infarction, and hypertension. Complications of uncontrolled blood pressure include stroke, aneurysms, heart failure, kidney disease, retinopathy, metabolic syndrome, and memory loss. These comorbidities lead to poor health outcomes and increased healthcare costs, which is unsustainable given our limited resources. Therefore, this study aimed to explore the relationship between dyslipidemia and blood pressure control in Chinese hypertensive patients. Screening for dyslipidemia will ensure early diagnosis and treatment. This will optimize blood pressure control and limit cardiovascular complications.

MATERIALS AND METHODS

This is a retrospective cross-sectional study conducted at the Hind Institute of Medical Sciences U.P to explore the correlation of vitamin D and serum lipid levels among patients with essential hypertension.

Inclusion criteria –

-Age more than 21 years old.

- Diagnosed with hypertension at least three months ago.

Exclusion criteria:

i) Hypertension > 1year of duration

ii) Secondary hypertension

iii)Diabetes mellitus, congestive heart failure, history of any atherosclerotic disease, urinary tract infection, any intercurrent illness, strenuous exercise and menstruation to rule out any proteinuria due to other causes. All the subjects were informed and consent letter was taken.

Assessments: The following data were collected from all patients at study entry: age (years), gender, duration of EH, smoking status, history of hypertension, and systolic and diastolic blood pressure (mm Hg) was calculated.

Biochemical analysis: Using aseptic precautions 3 ml of venous blood was collected from the antecubital vein in the Fasting condition. Samples were centrifuged after 30 minutes. Vitamin D remains stable for upto 72 hours in room temperature. Serum was isolated and used for the measurement of 25-**OH Vitamin D** by CLIA method (by COBAS E411 analyzer) and lipid pro le also measurement.

STATISTICAL ANALYSES

All the values were expressed as Mean ±SD. The statistical analysis was done using the student 't-test and Pearson's correlations for comparison between the twogroups and a p-value of <0.05 was considered statistically significant.

RESULT

Table-1: the study included 200 hypertensive patients. Ages ranged from 21 to 80 years with a mean age of 56.2 ± 11.8 years. 107 of the participants (56%) are females.

Personal data	No (200)	%
Age in years		
21-30	6	3
31-40	12	6
41-50	36	18
51-60	74	34
60+	72	36

TABLE 1: Personal characteristics of sampled patients with hypertension

Table-2: Illustrates lipid profile and vitamin D levels among hypertensive patients according to their gender. Cholesterol levels were insignificantly higher among female hypertensive patients than males (191.4 vs. 181.9 mg/dl; P = 0.062). HDL among females was 54.2 mg/dl compared to 42.9 mg/dl for male patients, with a statical significant difference (P = 0.001). Triglycerides and LDL levels were insignificantly different among male and female patients. Considering vitamin D, the average level among male patients was 26.526 ng/ml compared to 26 ng/ml% among females (P = 0.742).

Lipid profile & vitamin-D	**Gender**				**p-value**
	Male		**Female**		
	Mean	**SD**	**Mean**	**SD**	
Cholesterol	181.9	35.0	191.4	34.0	0.062
HDL	42.9	9.3	54.2	14.2	0.001*
TG	151.3	83.8	143.7	67.3	0.580
LDL	106.6	32.4	104.1	25.7	0.487
Vitamin-D	26.5	10.5	26.0	9.7	0.742

Table-2: Lipid profile and vitamin D levels among patients with essential hypertension patients according to their gender

Table-3: reveals lipid profile and vitamin D levels among hypertensive patients according to age. Cholesterol levels were insignificantly higher among 40-60 aged hypertensive patients than among the old (189.4 vs. 184.4 mg/dl; P = 0.627). HDL among patients aged 20-39 years was 38.0 mg/dl compared to 52.3 mg/dl for patients older than 60 years with a statical significant difference (P = 0.002). Triglycerides were significantly higher among patients aged 20-29 years old (210.6 mg/dl) than those older than 60 years (129 mg/dl) with P = 0.001. Regarding vitamin D, the average level among young patients (20-29) was 22.7 ng/ml compared to 25.5 ng/ml for patients aged 40-60 years and 28.2 ng/ml for those who are older than 60 years (P = 0.129).

Lipid profile & vitamin-D	**Age in years**						**p-value**
	20-39		**40-60**		**60+**		
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	
Cholesterol	185.3	33.4	189.4	35.5	184.4	33.9	0.627
HDL	38.0	6.9	48.7	12.4	52.3	14.8	0.002*
TG	108.1	30.7	105.9	31.8	103.2	22.1	0.803
LDL	210.6	145.3	150.8	72.0	129.0	50.3	0.001*
Vitamin-D	22.7	8.2	25.5	9.5	28.2	10.9	0.129

TABLE 3: Lipid profile and vitamin D levels among essential hypertension patients according to their age

Table-4: following figures clarify correlation analysis (between vitamin D & lipid parameters) and linear regression analysis of hypertensive patients showing dependency of vitamin D on other variables. Vitamin D has a significant positive intermediate negative crude correlation with cholesterol level (r = -0.26; P = 0.001) and a significant negative intermediate correlation with triglycerides (r = -0.25; P = 0.024). Adjusted relation of vitamin D with lipid profile through regression model showed that only triglycerides have a significant adjusted negative relation with vitamin D keeping all other factors constant.

Lipid profile	**Correlation analysis**		**Regression analysis**	
	R	P	B	P
Cholesterol	-0.26*	0.001*	-0.12	0.899
HDL	0.04	0.654	0.03	0.829
TG	-0.11	0.069	-0.04	0.673
LDL	-0.25*	-0.024*	-0.05	0.012*

DISCUSSION

The present study aims to explore the possible association between 25 hydroxyvitamin D levels and serum lipid levels among patients with essential hypertension. We found that essential hypertension was more prevalent among participants aged 51 years and above (74.3% collectively). In addition, the number of female hypertensive patients was slightly higher than males (56.0%, 44.0%, respectively). In a study done in the rural hypertensive population in China from 2004 to 2006 involving 6,412 individuals (2805 men and 3607 women) all above 35 years of age,51.3% had high total cholesterol,8.8% had low HDL, 20.1% had high LDL and 35.7% had high triglycerides levels. (Zhang *et al*., 2007). In Congo, a study showed that the prevalence of dyslipidemia among hypertensive patients was 40%. Those with elevated total cholesterol were 23% (Lepira *et al.*, 2005). These findings were almost similar in the three studies except the LDL which were highly raised in my study.

In the current study, dyslipidemia was detected among 148 (77.5%) patients. High cholesterol levels were recorded among 61 (32.3%) patients. As for HDL, 121 (66.9%) hypertensive patients had high HDL levels (> 40 mg/dl). Considering triglycerides, 64 (33.9%) patients had high levels, and 94 (57.7%) patients had a high LDL level. The most-reported isolated lipid

abnormalities were elevated triglyceride levels more than 150 mg/dl (14.1%), and low HDL < 40 mg/dl (6.3%). The most-reported combined lipid abnormalities were abnormal cholesterol and triglyceride levels (11%), then abnormal HDL and LDL levels (8.4%), and 6.8% of the subjects had abnormal cholesterol, LDL, and triglycerides levels. A statistically significant difference was detected in HDL levels among females and males (P = 0.001). In addition, HDL and triglycerides had a statically significant difference with age groups of the hypertensive patients (P = 0.002, P = 0.001, respectively).

We found that 106 (67.5%) hypertensive patients had deficient vitamin D levels, 48 (30.6%) had insufficient vitamin D levels. There is no statistically significant difference identified in vitamin D levels between hypertensive males and females and between age groups (P = 0.742, P = 0.129, respectively). This study also found a significant positive intermediate negative crude correlation was found between vitamin D and cholesterol level (P = 0.001), in addition to the significant negative intermediate correlation between vitamin D and triglycerides (P = 0.024). However, only triglycerides have a significantly adjusted negative relation with vitamin D through the regression model (P = 0.012).

CONCLUSIONS

Vitamin D deficiency is highly prevalent among essential hypertensive patients. In addition, dyslipidemia among essential hypertensive patients might be influenced by vitamin D deficiency. Further, long-term and more comprehensive randomized controlled trials are needed to make firmer conclusions and stronger evidence on this beneficial role of vitamin D treatment on essential hypertensive

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