A STUDY OF BLOOD LEAD LEVELS IN YOUNG HYPERTENSIVE PATIENTS

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ABSTRACT

BACKGROUND

Lead is a normal constituent of the earth's crust, with trace amounts found naturally in soil, plants and water. Over the years lead has become one of the most popular elements in the manufacturing of man-made products. Lead, having no beneficial role to humans enters the body through multiple routes and gets distributed and stored in almost every organ resulting in the defective functions of the organ. This study has been undertaken to determine whether the blood lead level has any role in Hypertension.

The objectives of the study are to estimate the blood levels in young patients with Hypertension and compare with the older patients.

MATERIALS AND METHODS

Patients with Systolic blood pressure more than 140 mmHg and/or Diastolic blood pressure more than 90 mmHg and/or current use of blood pressure–lowering medication constitute the study population and patients with secondary causes of hypertension were excluded. Patients were further investigated for complete blood count, fasting lipid profile, serum electrolytes, Electrocardiogram, 2D echocardiograph and blood lead levels.

Settings and Design- A descriptive cross-sectional study was conducted among 100 Primary hypertensive patients attending Medicine and Cardiology Out Patient Department in a private medical college over a period of 12 months. They were categorized into 2 groups of 50 each based on their age (younger group <45 yrs. and older group > 45 yrs.).

Statistical Analysis- Results were analysed using IBM SPSS version 19.0 at 5% level of significance. The suitable statistical techniques used are linear discriminant analysis and independent sample t test. Wilk's Lambda value (p-value = 0.000*) was observed to be significant.

RESULTS

In Young primary hypertension patients studied, the mean age was 39.22 with a standard deviation of 5.4 years whereas in old primary hypertensive patients, the mean age was 60.26 with a standard deviation of 6.7 years. Among younger patients, 66% (n=33) were men and 34% (n=17) were women as compared to 44% (n=22) men and slightly higher percentage of women around 56% (n= 28) among the old primary hypertension patients. The mean blood lead level was 11.330 mg/dl among younger patients as compared to mean of 21.172 mg/dl among the older age group indicating a significant increase in blood lead levels as the age progresses, though the lead levels were in normal range.

CONCLUSION

The study revealed a significant correlation of serum lead concentration with progression of age, though no such correlation was found with Hypertension. However further studies with larger sample size and data in regard to specific occupation, life style and geographic location can yield significant results to attribute serum lead as a risk factor for developing cardiovascular disease.

KEYWORDS

Blood Lead Levels.

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BACKGROUND

Over the years lead has become one of the most popular elements in the manufacturing of Man - made products. This metal is a much sought-after component in the manufacturing industry not only due to its abundance in nature, but also because of its desirable properties.[1] Occupational related lead exposure occurs in adults, notably workers at great risk are smelter and foundry workers, workers engaged in waste disposal, shipyard workers, and construction workers exposed to lead painted

steel. Furthermore, exposure outside the workplace can occur from inhalation of lead-contaminated air, ingestion of lead- contaminated dust and soil, consumption of lead polluted water, lead adulterated food and lead supplemented medicine. Since lead poisoning is a preventable condition, all necessary steps must be taken for its early detection and prevention.

Cardiovascular toxicity especially, incidence of hypertension and stroke was reported more than a century ago through occupational lead exposure. Large scale epidemiological studies have established a relationship between hypertension and lead in general US population. The present study is undertaken to estimate the blood lead levels in young hypertensive patients and to determine if lead plays a role in cardiovascular disease.

Aims and Objectives

To estimate the blood levels in young patients with Systemic Hypertension and compare with the older patients.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted among 100 Primary hypertensive patients attending Medicine and Cardiology Out Patient Department in a private medical college over a period of 12 months. They were categorized into 2 groups of 50 each based on their age (younger group <45 yrs. and older group > 45 yrs). Blood pressure was measured thrice during the visit and blood pressure measurements for each participant was averaged, and Hypertension was defined as Systolic blood pressure more than 140 mm Hg and/or Diastolic blood pressure more than 90 mm Hg and/or current use of blood pressure–lowering medication. Patients with secondary causes of hypertension are excluded. Patients were further investigated for complete blood count, fasting lipid profile, serum electrolytes, Electrocardiograph, 2D echocardiograph and blood lead levels.

Ethics

The study was carried out after taking Institutional Ethical Committee Clearance and informed consent from the patients.

Statistics

The entire analysis has been carried out using IBM SPSS 19.0 version at 5% level of significance. The suitable statistical techniques used are linear discriminant analysis and independent sample t test and Wilks's Lambda value (p value= 0.000) was observed to be significant. The total percentage of correct classification was observed to be 85% and the Fisher's linear discriminant function was used.

RESULTS

A descriptive cross-sectional study was conducted among 100 Primary hypertensive patients attending Medicine and Cardiology Out Patient Department in a private medical college over a period of 12 months. They were categorized into 2 groups of 50 each based on their age (younger group <45 yrs. and older group >45 yrs). In Young primary hypertension patients studied, the mean age was 39.22 with a standard deviation of 5.4 years where as in old primary hypertensive patients the mean age was 60.26 with a standard deviation of 6.7 years. Among younger patients 66% (n=33) were men and 34% (n=17) were women as compared to 44% (n=22) men and slightly higher percentage of women around 56% (n= 28) among the old primary hypertension patients, though not statistically significance. Smoking and alcohol consumption was seen among 60.6% of young men and 72% of older men in the study and none of the women among both the groups gave a history of smoking or alcohol consumption.

In young primary hypertension patients studied, the mean BMI was 23.47 with a standard deviation of 2.23 kg/m2, whereas in old primary hypertensive patients the mean BMI was 21.52 with a standard deviation of 1.9 kg/m2. The prevalence of Diabetes among old hypertensive patients was higher (38%) than those among the younger group. In both the groups studied, the mean systolic blood pressure was 150.4 mmHg and the mean diastolic blood pressure was also more or less similar (98.56 mmHg among young patients; 97.8 mmHg in old patients).

The mean haemoglobin levels were similar in both the groups (13.45 gm/dl in young and 13.22 gm/dl in old primary hypertensive patients). In young primary hypertension patients studied, the mean total cholesterol, triglyceride and low-density lipoprotein were (178.6 mg/dl, 162.7 mg/dl and 103.2 mg/dl respectively) higher than those observed among (152.5 mg/dl, 144.94 mg/dl and 80.88 mg/dl respectively) old primary hypertensive patients. The mean high-density lipoprotein and very low-density lipoprotein levels were similar in both the groups (around 48 mg/dl and 38 mg/dl respectively).

Using cock craft formula GFR was calculated to rule out chronic kidney disease. In young primary hypertension patients studied the mean GFR was 132.91 ml/min with a standard deviation of 33.88 ml/min whereas in old primary hypertensive patients the mean GFR was 108.02 ml/min with a standard deviation of 20.23 ml/min. Serum Potassium was measured to rule out Conn's syndrome and the mean serum potassium levels were similar (around 4 meq/l) in both the groups. 2D Echocardiograph revealed Concentric Left Ventricular Hypertrophy in about 30% (n=15) and mean EF of 58.08% among young primary hypertension patients and slightly higher percentage of concentric LV hypertrophy in about 42% (n=21) and lower mean EF of 52.28% among older patients.

The mean blood lead level was 11.330 mg/dl among younger patients as compared to mean of 21.172 mg/dl among the older age group as in table no. 1. There is a significant increase in blood lead levels observed as the age progresses as in fig. no. 1. On applying the linear discriminant analysis with stepwise methodology, the variables Serum Lead was included in the model. Wilk's Lambda value (0.159, p value = 0.000*) was observed to be significant, which means that the parameters of two age group categories differ significantly to each other. The

result shows a significant difference between the two age group categories with respect to Serum Lead with t test value of 20.555 and p value of 0.000.

	Age Group	N	Mean	Std. Deviation
Sr. LEAD	<=45 years	50	11.330 mg/dl	2.5121
	>45 years	50	21.172 mg/dl	2.2698

Table 1. The Mean and Standard Distribution of Serum Lead Levels in both the Groups

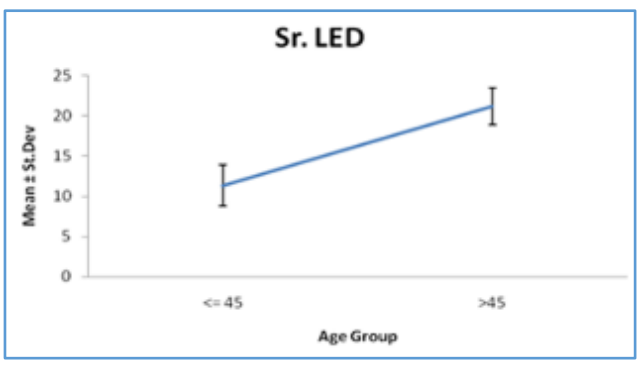

Figure 1. Association of Serum Lead Levels with Increase in Age

DISCUSSION

The effect of lead on human beings is lethal and affects various systems and organs and though explored and explained in various studies, the implications of it are either overlooked or ignored specially in developing countries like India. Several epidemiological surveys done in the past has linked lead to various adverse cardiovascular events starting from hypertension to atherosclerotic changes.[2,3] In this study we have divided the study population into two groups, namely the young and the old population with the age cut off in both the groups being an age less than 45 years and age more than 45 years respectively. The mean age of young population in this group was 39.22±5.448 and the old population was 60.26±6.746 years which is similar to other studies conducted previously.[4] Our study included patients from both the sexes with male preponderance in the young population group accounting to about 66% and female preponderance in the old hypertension group accounting to about 56%. The age and gender distribution were taken into consideration based on the previous study data from NCHS united states which concluded that the prevalence of hypertension was 6.8% among those aged 18–39, 30.4% for those aged 40–59, and 66.7% for those aged 60 and over.[4]

Obesity and hypertension are two disorders, which go hand in hand, and its association has been well established.[5,6,7,8] Obesity in our study was determined by body mass index (BMI) in accordance to the WHO criteria by which an obese individual was determined with a BMI more than 27 kg/m2. The mean BMI in the two groups of our study were 23.47±2.236 kg/m2 and 21.52±1.972 kg/m^2. In a previous study by F Tesfaye et al on three groups of population across the globe, it was concluded that BMI had a significant effect on both systolic and diastolic BP.[9] Thus the possible confounding effects of BMI on hypertension was ruled out in our study.

Lipids and BP have been associated in several cross-sectional studies.[10,11,12] Castelli and Anderson found that BP and serum cholesterol were strongly correlated among hypertensive patients, which led to early recommendations to treat elevated cholesterol in patients with hypertension.[11,13] The study populations in both the groups were screened for dyslipidaemia and those with dyslipidaemia were excluded from the study. The mean ±standard deviation for the lipid profile parameters in the order of total cholesterol, triglycerides, high density lipoprotein, low density lipoprotein, very low-density lipoprotein were 178.6±48.6, 162.7±57.2, 48.7±25.3, 103.2±35.7, 38.3±13.09 mg/dl for young hypertension group and 152.5±40.6, 144.9±65.9, 48.2±24.9, 80.8±35.4, 38.7±15.3 mg/dl for the old hypertension group. Proper interventions for the correction of dyslipidaemia were administered and advised for the excluded study population.

Three primary causes of secondary hypertension namely hypertension secondary to chronic kidney disease (CKD), Conn's syndrome, Pheochromocytoma were ruled out. CKD was ruled with calculation of Glomerular filtration rate (GFR), which was mean ± standard deviation 132.9±33.8, 108±20.23 ml/min for young and old hypertension population respectively using the Cockroft and Gault formula. Conn's syndrome was ruled out with potassium levels. The mean ± standard deviation potassium levels in the two groups were 4.04±0413, 4.13±0.39, thus ruling out Conn's syndrome. Pheochromocytoma was ruled out in the young hypertension group by evaluating plasma metanephrine and normetanephrine levels. The above-mentioned conditions were excluded to attribute the direct effects of lead on hypertension and were identified as confounding factors.

The mean systolic BP in young and old hypertensive population were 150.4±6.3 mmHg, 150.4±7.8 mmHg. The mean diastolic BP in young and old hypertensive patients were 98.56±5.9 mmHg, 97.8±6.1 mmHg. Hypertension was diagnosed in accordance to joint national committee 7 (JNC 7).[14] It was further confirmed with echocardiography findings suggestive of left ventricular hypertrophy which was seen in 42% in old hypertensive patients and 30% in young hypertensive patients. Heart failure patients were included in our study in accordance to the ejection fraction with a mean of 58.08±3.9 in the young hypertensive patients and 55.28±6.5 in the old hypertensive patients. Severe heart failure patients were excluded.

Serum lead concentration in the young hypertensive population was 11.33±2.51 µg/dl and in the old hypertensive population was 21.17±2.27 µg /dl. Our results have emphasized on the statistically significant increase of lead concentrations in the serum with the progression of age. As per Frumkin Howard from Agency for Toxic substance and disease registry, the normal level of serum lead ranges between 10 µg/dl – 60 µg/dl.[15] In

addition to the serum lead levels, the lethality of lead in our study population was observed via haematological analysis to look for basophilic stippling and none was observed in the study population of both the groups. The results published by previous meta-analysis of 31 studies proved a statistical significance in association between serum lead and hypertension with an increase in blood pressure (BP) of 1.0 mmHg and 0.6 mmHg in systolic and diastolic BP.[16] The NHANES I–IV studies have demonstrated a decline in blood pressure with decreased exposure in lead exposure in the study population.[2,17,18] However in our study the serum lead levels were within normal limits in the two population groups which were diversified with geographical distribution and occupation. Thus, the association between lead and hypertension could not be proven in our study population.

The incidence of hypertension can be attributed to various other factors like smoking and alcohol, which contribute to the correctible aetiologies and genetic predisposition a prime non-correctible factor. 40% in young hypertension group and 32% in old hypertension group were smokers. In young hypertensive group 46% and 32% in old hypertensive group were alcohol abusers. The details about the family history could not be elucidated accurately due to the lack of proper registry, ignorance and illiteracy among the study population. These factors could explain the incidence of hypertension in the study population with lead being within normal limits.

CONCLUSION

The impact of lead on the body is a grave cause of concern. This study was aimed at proving the diagnostic value and the potent toxic effects of serum lead in the incidence of cardiovascular disease particularly Primary Hypertension and to compare the serum lead level between young and old population was made to observe any change in the disease pattern. The serum lead levels were within normal limits in the two population groups which were diversified with geographical distribution and occupation; hence the association between lead and hypertension could not be proven in our study population. However, one imperative aspect of the study revealed increase in serum lead concentration as the age progresses. Further studies with larger sample size and data in regard to specific occupation, life style and geographic location can yield significant results to attribute serum lead as a risk factor for developing cardiovascular disease.

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