Patterns of Dyslipidaemia in Prehypertensive and Normotensive Subjects

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Abstract

Background: To study trends in levels of lipids in prehypertensive and normotensive people.

Methods: In this cross sectional study a total of 90 apparently healthy subjects with age being 30-59 years and without any other illness were selected. Blood pressure was monitored and categorised into normotensive group 1 (n=39) and prehypertensive group 2 (n=39). Any volunteer with raised blood sugar was excluded from the study. Their blood was collected and sera was separated after ultracentrifugation to analyze triglycerides, total cholesterol, LDL and HDL. Independent student t-test (2-tailed) was applied in order to compare difference between selected variables such as age, BMI, total cholesterol, LDL, HDL and triglycerides of normotensives and prehypertensive groups.

Results: Mean values of serum cholesterol, serum LDL, serum HDL and serum triglycerides were higher in prehypertensives than normotensives. Serum HDL was found to be relatively low in all subjects regardless of their blood pressure levels. No difference in demographic variables were found amongst two groups and were found within range.

Conclusion: Mean serum lipids were found to be raised in prehypertensives than normotensives but difference was statistically insignificant. Frequencies and percentages of serum lipids were higher in prehypertensives than normotensives but difference was statistically insignificant.

Key Words: Dyslipidaemia, Prehypertensives,

Introduction

Hypertension is defined as persistent elevations of systolic blood pressure at or above 140 mmHg and diastolic blood pressure at or above 90 mmHg. Prehypertension is defined as higher than normal blood pressure in which readings for systolic and diastolic blood pressure are below baseline values for hypertension. The seventh report of the joint National Committee for the detection, evaluation and treatment of high blood pressure (JNC-7) published in 2003 proposed new guidelines in which a person having systolic blood pressure ranging from 120 mmHg to 139 mmHg and diastolic blood pressure ranging from 80 to 89 mmHg will be considered as prehypertensive.

Prehypertension is an insidious disease and may go unnoticed for many years till state of full blown hypertension is achieved. State of prehypertension in clinical settings is usually an incidental finding. There are no specific signs and symptoms associated with prehypertensive state. State of prehypertension and its hazardous effects along with its treatment still remain controversial. Most studies have clearly demonstrated prehypertensive state to be as fatal as hypertensive state. Prehypertension is strongly linked with heart diseases, stroke and nephropathy as reported in several clinical studies. Population having prehypertension for extended period of time are at increased risk for developing malignant hypertension in future.

Sedentary lifestyle, higher body mass index (BMI) and increased dietary sodium can contribute to rise in blood pressure by middle age of adolescence if their values stay around cutoff point for prehypertension (120/80 mm Hg). National high blood pressure education program working group presented a fourth report on high blood pressure in adolescents and children which introduced the varying effects of prehypertension leading to increased risk of progression of chronic kidney disease and cardiovascular risk factors. Prehypertensive and hypertensive people have usually low arterial compliance which is due to the action of aldosterone on smooth walls of vessels and potentiating total peripheral resistance. Free fatty acids in the blood result in increased levels of cortisol via neuroendocrine reflex which results in increased production of angiotensinogen by the hepatocytes and enhancing vascular endothelial reactivity. Prehypertensive Pakistani population had higher circulating blood levels of various stress hormones namely cortisol and aldosterone which are
attributable to stressful life at a younger age which may develop into full blown hypertension. Dyslipidaemia is defined as deranged amount of blood lipids. Lipids such as cholesterol could be in either low or high amounts. Hyperlipidaemia is defined as increased levels of lipids in the blood. Levels of blood lipids may depend on phenotype or etiological factors such as interplay of genetics and mode of living like a sedentary one may play roles in deranging lipid profile. Prehypertension has been linked to the development of cardiometabolic disorders such as derangement of lipid profile thereby increasing incidence of heart diseases and various other problems. Relatively higher levels of triglycerides and LDL were detected in Indian, Chinese and Malay population without diabetes mellitus or hypertension but having prehypertension over a long period of time. Studies conducted in western world have also shown prehypertension as a risk factor for the development of deranged lipid profile. One of the analysis was done on healthy volunteers who took part in NHANES from 1999 to 2006 which revealed that prevalence of prehypertension and other metabolic disorders such as deranged lipids was at 36.3% (p<0.001). High LDL can lead to failure of endothelial relaxation of blood vessels thereby leading to state of subnormal blood pressure. A strong correlation was found amongst hypertension and raised lipids especially serum low density lipoproteins. Similarly, serum LDL, total cholesterol, triglycerides were found to be higher in young subjects having subnormal blood pressure and full blown hypertension along with a complex interplay of their BMI in a study done in US in 8th grade adolescents. However, mean lipid levels in US population were found to be higher in females than men and their levels varied from ethnicities to their area of living and diet. Risk for endothelial damage increases by atherogenic deposition of plaque in coronary vessels due to raised lipid during prehypertension.

Patients and Methods
This cross-sectional study was conducted at Centre for Research in Experimental and Applied Medicine (CREAM), and Armed Forces Institute of Pathology (AFIP), Army Medical College, Rawalpindi, National University of Science and Technology (NUST), Pakistan from Jan 2013 to Feb 2014. Approval from ethical committee of Army Medical College, National University of Sciences and Technology (NUST) was obtained before undertaking the research project. The study was conducted in accordance with the current Good Clinical Practices and the Declaration of Helsinki. A total of 90 apparently healthy subjects with age being 30-59 years and without any other illness were selected. Their blood pressure was monitored and categorised into normotensive group 1 (n=39) and prehypertensive group 2 (n=51). Any volunteer with raised blood sugar was excluded from the study. Their blood was collected and sera was separated after ultracentrifugation. Analysis of triglycerides, total cholesterol, LDL and HDL was done. Independent student t-test (2-tailed) was applied in order to compare difference between selected variables such as age, BMI, total cholesterol, LDL, HDL and triglycerides of normotensives and prehypertension groups.

Results
A total of 78 subjects were selected and their demographic variables such as age and BMI revealed no statistical difference (p>0.05). Total cholesterol was 164.74±32.52 mg/dl in normotensive group and 179.95±37.86 mg/dl in prehypertensive group with p>0.05. Serum triglycerides were 184.16±105.71 mg/dl in normotensive group and 209.18±102.16 mg/dl in prehypertensive group (p>0.05). Serum LDL was 92.44±24.89 mg/dl in normotensives whereas prehypertensives had slightly raised LDL values but difference was found to statistically not that significant. Similarly, serum HDL levels were 38.83±6.44 mg/dl and 41.04±7.77 mg/dl in both groups (p>0.05)(Table 1). Total cholesterol above its cutoff value was found in 5 normotensive and 30 prehypertensive individuals. Percentages above cutoff levels of total cholesterol were 12.8% in normotensives and 76.9% in prehypertensives respectively. However, desirable levels of total cholesterol below their cutoff levels of 200mg/dl were found in 34 normotensives and 9 prehypertensives. Percentages for desirable cholesterol levels were 87% and 23.1% in normotensive and prehypertensive groups respectively. Low density lipoproteins more than its cutoff levels were in 2 normotensives and 1 prehypertensives with percentages of 5.1% and 2.6% respectively. Similarly, LDL within acceptable levels i.e; below their cutoff values were present in 37 normotensives with a 94.9% and 38 prehypertensives with 97.4% (Table 2). Nine normotensives and 25 prehypertensives had cutoff values of triglycerides above 236mg/dl. Percentages were found to be 23.1% and 64.1% in normotensives and prehypertensives respectively. Triglycerides within desirable levels were...
present in 30 normotensives and 14 prehypertensives with desirables percentages as 76.9% and 35.9% respectively. Desirable HDL levels were actually set above cutoff level of 45 mg/dl and were found in only 6 normotensive subjects and 26 prehypertensive subjects whereas percentages for normotensives and prehypertensives were 15.4% and 66.7% respectively. HDL below cutoff value were present in 33 normotensive subjects and 10 prehypertensive subjects with percentages of 84.6% and 25.6% respectively (Table 2).

Table 1: Comparison of age, BMI, SBP, DBP and serum lipid profile between normotensive and prehypertensive groups

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Normal group</th>
<th>Prehypertensive group</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in Yrs</td>
<td>38.7±4.71</td>
<td>38.07±3.84</td>
<td>0.547</td>
</tr>
<tr>
<td>BMI (Kg/m²)</td>
<td>24.67±2.30</td>
<td>25.20±2.27</td>
<td>0.305</td>
</tr>
<tr>
<td>Cholesterol (mg/dl)</td>
<td>164.7±32.52</td>
<td>179.95±37.86</td>
<td>0.61</td>
</tr>
<tr>
<td>Triglyceride (mg/dl)</td>
<td>184.16±105.71</td>
<td>209.18±102.16</td>
<td>0.291</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>92.44±24.89</td>
<td>98.43±21.05</td>
<td>0.254</td>
</tr>
<tr>
<td>HDL (mg/dl)</td>
<td>38.83±6.44</td>
<td>41.04±7.77</td>
<td>0.176</td>
</tr>
</tbody>
</table>

Recommended range (NCEP Coordinating Committee): Total Cholesterol< 200mg, LDL< 130 mg/dl, Triglycerides <236 mg/dl, HDL>45mg/dl

Table 2: Serum lipids above and below cutoff levels in prehypertensive and normotensive subjects

<table>
<thead>
<tr>
<th>Variables</th>
<th>Levels of lipids</th>
<th>CVHRisk status</th>
<th>Normotensive</th>
<th>Prehypertensive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percentage</td>
<td>Frequency</td>
<td>Percentage</td>
</tr>
<tr>
<td>Total Cholesterol (mg/dl)</td>
<td>&gt;200mg/dl</td>
<td>High</td>
<td>30</td>
<td>76.9%</td>
</tr>
<tr>
<td></td>
<td>&lt; 200mg/dl</td>
<td>Desirable</td>
<td>9</td>
<td>23.1%</td>
</tr>
<tr>
<td>LDL (mg/dl)</td>
<td>&gt;130mg/dl</td>
<td>High</td>
<td>2</td>
<td>5.1%</td>
</tr>
</tbody>
</table>
|                      | <130mg/dl | Desirable | 37 | 94.9%
| Triglyceride (mg/dl)  | >256mg/dl | High | 9 | 25.1% |
|                      | <256mg/dl | Desirable | 39 | 74.9% |
| HDL (mg/dl)           | >45mg/dl | Low | 10 | 25.6% |
|                      | <45mg/dl | Desirable | 26 | 66.7% |

Recommended range (NCEP Coordinating Committee): Total Cholesterol< 200mg, LDL< 130 mg/dl, Triglycerides <236 mg/dl, HDL>45mg

Discussion

Present study conducted in prehypertensive and control groups showed no statistical differences. However, levels of serum lipids were relatively higher in prehypertensive group compared to control group. Contrary to the present study, association was found between prehypertension and dyslipidemia in a cross sectional study done on 767 healthy military personnel. However multivariate logistic regression analysis showed positive association with body mass index and age as well.

It has been already known that essential hypertension is associated with metabolic syndrome. However its link to the state of prehypertension has not been established. Increase in blood lipids such as total cholesterol and triglycerides were noted with gradual increase in systolic and diastolic blood pressures in a community based cohort study. Moreover, a fall in high density lipoproteins was noted as well. Other parameters which were found to be raised were high blood glucose levels thereby indicating increase in insulin resistance and an increase in accumulation of fat tissue.

In Mongolian and Han people good correlation was found between prehypertension and raised serum lipids and BMI along with age and smoking. A population based study was done in Utah in which all subjects were having elevated blood pressure levels and a strong association was found between hypertension and elevated levels of serum cholesterol, serum triglycerides, serum LDL and HDL. However, this study also included siblings of same parent so chances of familial dyslipidaemia must be taken into account. Deranged serum lipids can be due to the complex interplay of elevated blood pressure levels and might be due to hereditary factors.

Owing to the strong link between hypertension and dyslipidaemia, lifestyle modifications and several drug regimens have been proposed by JNC-7 and third report of NCEP in order to curb cardiovascular diseases. Dyslipidaemia can itself be strong predictor of future development of prehypertension and hypertension. Physician health study revealed that healthy volunteers in the highest quantities of total cholesterol were more likely to suffer from elevated blood pressure levels than those subjects whose total cholesterol remained within lowest quintile.

References