Evaluation of Lipid Profile, Calcium and Alkaline Phosphatase in Pregnancy Induced Hypertension Women

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Abstract

Pregnancy induced hypertension is a main cause of maternal mortality and morbidity. The aim of the present study was destined to evaluate the association of blood Rheology of complicated pre-eclampsia and its comparison with that in normal pregnancy and normal non-pregnant woman. The grouping was done as group I (normal, non-pregnant women) and group II (normal pregnant women) and group III (pregnancy with PIH) Mean age range was 20-35 years. Serum lipid profile, calcium and alkaline phosphatase were monitored in pre-eclampsia, normal pregnant and normal non-pregnant women. The normal pregnancy was associated with significant increase in HDL-cholesterol, VLDL-cholesterol, Triglyceride, Alkaline phosphatase, with no significant increase in T- cholesterol and significant decrease in LDL-cholesterol and serum calcium when compared to normal non pregnant woman. A significant rise of total cholesterol, triglyceride, LDL cholesterol, VLDL-cholesterol, Alkaline phosphatase and fall in HDL-cholesterol and serum calcium was observed with the pre-eclampsia when compared with normal and control groups. Decreased HDL cholesterol and delayed triglyceride clearance and high blood pressure are associated with development of pre-eclampsia and eclampsia, this association may be crucial for understanding the pathologic processes of pre-eclampsia and eclampsia and may helpful for prevention.

1 Introduction

Nearly 200 years ago, Alexander Hamilton described PIH. Hypertensive disorders complicating pregnancy are common and form one of the deadly triads, along with hemorrhage and infection that contributes to maternal morbidity and mortality. Hypertension which appears after mid-term (20 weeks) and resolve within 10 days of postpartum without other symptoms of pre-eclampsia in a previously normotensive woman is called pregnancy-induced hypertension (PIH) or gestational hypertension. PIH is a multi-system disorder of human pregnancy with a genetic predisposition. It effects maternal renal, cerebral, hepatic functions and clotting factors while elevating blood pressure. The fetus is effected through placental insufficiency arising from abnormal placentation.

Alkaline phosphatase is synthesized in placenta during pregnancy has a role in cell division in normal and transformed cells. Alkaline phosphatase is responsible for active transport of phosphate. In pregnant woman, decrease in serum level of ALP may be associated with IUGR (Intra Uterine Growth Retardation), ALP activity has been appreciably increased in case of pre-eclampsia. Epidemiological studies suggest an inverse relationship between Calcium intake and the incidence of PIH. A review study found that calcium supplementation reduced the incidence of high blood pressure in the pregnant woman at risk of PIH. Changes in lipid metabolism occur during pregnancy to ensure a continuous supply of nutrients to the growing fetus despite intermittent maternal food intake.

The aim of the present study is to measure the serum levels of calcium, alkaline phosphatase, lipid profile among non-pregnant women of reproductive age group 18-35 normal pregnant women without PIH and pregnant women with PIH of the same age group.
and to see whether there is any significant change in the above parameters in these groups.

2 Material and Methods

2.1 Methodology

It was a case-control study done in the Department of Biochemistry, Deccan College of Medical Sciences from June 2008 to June 2009, total 30 pregnant women of 20-35 years old were selected and grouped as follows:

Group I: Non pregnant women with normal blood pressure
Group II: Women having normal uncomplicated pregnancy without hypertension (Control)
Group III: Women with pregnancy-induced hypertension (PIH) 30 pre-eclampsia.

Inclusion criteria were ranging with gestational age 24 weeks to term. Exclusion criteria was preexisting hypertension, IHD, CRF, DM treatment with drugs may interfere lipid profile. The pre-eclampsics patients were diagnosed by the presence of persistent hypertension (more than 140/90 mmhg) gross proteinuria (tested by heat test of urine and pathological edema). All the subjects in the group were in the third trimester of pregnancy. Blood samples were drawn from all the subjects following a fast of 12hrs and analyzed for serum triglycerides, total cholesterol, and HDL cholesterol by enzymatic end point method with the help of kits on ERBA chem-5 semi-auto analyzer. The value of LDL-Cholesterol was calculated based on Friedewald’s equation:

\[
\text{LDL Cholesterol} (\text{mg/dl}) = \text{Total Cholesterol} - \frac{\text{Triglycerides}}{5} - \text{HDL Cholesterol}
\]

VLDL (mg/dl) = TG/5

Serum Alkaline phosphatase determined by reagent kit method and calcium measured by end point assay. Data were statistically analyzed by student’s t test and significance was expressed in terms of ‘p’value.

2.2 Statistical Analysis

For the groups non pregnancy normotensive (Group I), Pregnancy without hypertension (Group II) and pre-eclamptic toxemia (Group III), the descriptive normally mean, standard deviation, minimum and maximum were computed. To see the differences in between the groups, one way analysis of variance (ANOVA) procedure using the Statistical Package for the Social Science (SPSS) program (SPSS Statistics 22.0) was applied. The differences between the individual pairs were seen by means of least square differences (LSD). The P values were given at appropriate places. A statistically significant difference was considered at p < 0.05.

3 Results

3.1 Total Cholesterol

In the present study there was no significant difference in serum cholesterol levels between group I (normal, non-pregnant women) and group II (normal pregnant women). However, a significant difference was observed between group I and group III (pregnancy with PIH) the P values being <0.001. The serum cholesterol levels in group III were significantly higher than those in group I. However, there was a significant difference in serum cholesterol levels between group II and group III. The P value being <0.001 (Table 1).

3.2 Triglyceride

In the present study the serum TG levels in group II are significantly higher than in group I P<0.001. The TG levels in group III were higher than in group I P<0.001. Comparison between group II and III showed significant difference. The levels of TG in group III are higher than in group II P<0.001 (Table 1).

3.3 HDL Cholesterol

In the present study, the HDL cholesterol levels in group II were significantly higher than in group I. However, there was no significant difference in HDL cholesterol levels of group I and group III subjects (Table 1).

3.4 LDL Cholesterol

The LDL cholesterol levels in our study showed a significant decrease in group II as compared to group I. P<0.001. There was no significant difference in LDL cholesterol levels when comparing group I and group III (Table 1).

3.5 VLDL Cholesterol

In the present study, the VLDL cholesterol levels in group II were significantly higher than in group I. The VLDL cholesterol levels in group III were also significantly higher than in Group I. When group II and III were compared the VLDL cholesterol in group III were significantly higher than in group II P<0.001 (Table 1).

3.6 Alkaline Phosphatase

The serum levels of alkaline phosphatase in group II were significantly higher than group I. The levels in group III were significantly higher than group II as well as group-I (P<0.001) (Table 2).

3.7 Calcium

In our study, the serum calcium levels in normal pregnant women group II were significantly lower than the normotensive non-pregnant women (group - I) serum calcium levels in pregnancy induced hypertensive women group - III were significantly lower than that in normal pregnant women group - II (P<0.001) (Table 2).

4 Discussions

4.1 Total Cholesterol

In the present study, there was no significant alteration in total cholesterol levels could be observed in normal pregnancy as compared with normal non-pregnant women. These findings are similar to one of the findings of Sattar et al. However, the study of Sattar et al., also observed no significant alteration in pre-eclampsia.

In our study, the cholesterol level in group III (PIH) are significantly higher than group I and group II. These findings are similar to that of Roohi et al. Evaluation of Lipid Profile, Calcium and Alkaline Phosphatase
Adegoke OA and Hubel CA, who have found significant increase in serum total cholesterol in toxemia of pregnancy.

### Table 1 Lipid profile level in pregnancy-induced hypertension

<table>
<thead>
<tr>
<th>Groups</th>
<th>TC (mg/dl)</th>
<th>TG (mg/dl)</th>
<th>HDL (mg/dl)</th>
<th>LDL (mg/dl)</th>
<th>VLDL (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>211.46±12.23</td>
<td>120.73±11.08</td>
<td>47.06±8.05</td>
<td>140.26±16.12</td>
<td>24.13±2.25</td>
</tr>
<tr>
<td>Pregnant</td>
<td>219.06±19.84*</td>
<td>215.60±23.28*</td>
<td>60.73±11.19*</td>
<td>115.20±20.97*</td>
<td>43.13±4.76*</td>
</tr>
<tr>
<td>PIH</td>
<td>236.33±35.20*</td>
<td>275.60±36.83*</td>
<td>45.93±6.72</td>
<td>135.26±31.64</td>
<td>55.14±7.42*</td>
</tr>
</tbody>
</table>

Values are expressed as MEAN ± SEM; n=5 P<0.001, * Significant difference from control group at P<0.001

### Table 2 Alkaline phosphate and Calcium level in pregnancy-induced hypertension

<table>
<thead>
<tr>
<th>Groups</th>
<th>ALK (U/L)</th>
<th>Ca (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>189.13±10.41</td>
<td>10.03±0.35</td>
</tr>
<tr>
<td>Pregnant</td>
<td>301.67±17.39*</td>
<td>9.12±0.59</td>
</tr>
<tr>
<td>PIH</td>
<td>416.53±30.69*</td>
<td>7.56±0.55</td>
</tr>
</tbody>
</table>

Values are expressed as MEAN ± SEM; n=5 P<0.001, * Significant difference from control group at P<0.001

4.2 Triglyceride
A significant increase in serum TG levels in third trimester of pregnancy was observed in the present study. Similar results were observed in previous studies. Estrogen includes the hepatic biosynthesis of endogenous TG’s which is carried by VLDL. In our study also serum TG levels were significantly higher in normal pregnant women as compared with normal non-pregnant women. Serum triglyceride concentrations rose significantly in PIH as shown in our study which corroborated with the findings of many workers Jayantha De, Enquobahria, Cekmen. Increased Triglyceride, found in Pregnancy Induced Hypertension, is likely to be deposited in predisposed vessels.

4.3 LDL Cholesterol
A significant fall in LDL cholesterol levels in third trimester of normal pregnancy was also observed by other workers. They have also reported a significant increase in LDL in PIH. These findings are similar to our study. Hypoestrogenaemia, predominance of smaller and denser serum LDL particles are supposed to be important contributors for endothelial dysfunction in PIH.

4.4 VLDL Cholesterol
The increase in VLDL is due to hypertriglyceridemia leading to enhanced entry of VLDL that carries endogenous triglyceride into circulation. VLDL level further increased in PIH as evidenced in the present study in corroboration with those of other workers. In our study the HDL cholesterol were significantly increased in normal pregnancy over non-pregnant women. We have also found a significant decrease in HDL-C in PIH as compared with normal pregnant women. These findings correlate with the findings of Jayantha De. The low level of HDL in pre-eclampsia is because of hypoestrogenemia and also due to insulin resistance.

4.5 Alkaline Phosphatase
Many workers have worked on serum alkaline phosphatase showing rising levels in the 2nd and 3rd trimester of pregnancy, which coincides with the period of calcification of fetal skeletal. PALP facilitates the mobilization of calcium from maternal system for fetal calcification process. Me Placental alkaline phosphatase first appears in 1st trimester of pregnancy and increases during gestation to comprise 40-67% of the total serum phosphatase during the third trimester. It was noticed that increase of placental activity is directly related to increase in maternal blood pressure. The increasing hypertension in our study it has been noticed that PALP levels in serum are significantly raised in PIH. As there is an increase in intensity of localization of PALP in placenta with the increase of maternal blood pressure, similar correlation is observed between rising serum levels of PALP with increasing hypertension. And these PALP levels in serum and placenta are affected by increasing maternal blood pressure during pregnancy.

4.6 Calcium
During pregnancy, there is great demand for calcium intake to respond to the higher demands caused by the process of fetal bone formation. There is a dilution of the cation due to the expanded extra cellular fluid volume and to the normal hypercalciuria of pregnancy consequent to increased glomerular filtration. Serum ionized calcium concentrations depend on an adequate calcium intake.
5 Conclusions
A comparative study of lipid profile, calcium and alkaline phosphatase was done in females in the reproductive age group (20-35 years) as controls, 30 pregnant women in the age group (20-30 years). Normotensive in the third trimester and 20 women with pre-eclampsia with significant signs and symptoms in the age group between (20-30 years) in their third trimester.

Increased TG in PIH is likely to be deposited in predisposed vessels and contribute to endothelial dysfunction.

Thus, the assessment of blood lipids may be helpful in prevention of complications in PIH.

Increase levels of alkaline phosphatase in PIH are attributed to the increased blood pressure. The increasing hypertension causing increased PALP activity can be explained by ischaemia resulting due to maternal hyper tension.

PIH women present a reduction in extra cellular calcium concentration with low levels of serum-ionized calcium. It was proposed that beneficial effect of calcium supplementation in the prevention of PIH could be related with the maintenance of plasma ionized calcium levels within the narrow physiologic ranges.

6 Acknowledgements
The authors are gratefully acknowledged to the Department of Biochemistry, Deccan College of Medical Sciences, Hyderabad, India for providing the necessary facilities to carry out the research project successfully. Further more the authors would like to extend their special thanks to Dr. Ayesha Jahan, Dr. Zahida Nasreen, Dr. Tahmeen, Dr. Ajaz Hussain, Dr. Mumtaz Hussain, Dr. Ayesha Jehan and Mr. Salman for their encouragements and supports during the research work.

7 Conflict of interests
The authors declare that they have no competing interests.

8 References

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