Original Article

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Biochemistry Section

Comparison of Lipid Profile in Normotensive Pregnant Women and Hypertensive Pregnant Women in the Third Trimester

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ABSTRACT

Introduction: Toxemia in pregnancy or Pregnancy Induced Hypertension (PIH) is an idiopathic multisystem disorder specific to human pregnancy. It is a dangerous complication of pregnancy but phasic and is still one of the leading causes of maternal and foetal morbidity and mortality.

Aim: The aim of the study was to assess the serum lipid profile in normotensive pregnant women and hypertensive pregnant women in third trimester and to explore the possibility of serum lipid profile as a marker of severity of PIH.

Materials and Methods: The present study was conducted on 60 hypertensive (toxemic) (B1-40 pre-eclamptic) (B2-20 eclamptic) pregnant women and 60 normotensive pregnant women (A) of age between 19-35 years and gestational age ranging between ≥28 weeks to term as a case-control study. Serum lipid profile for both the groups were determined using various biochemical kits. Data was subjected to statistical analysis using mean, standard error and student's t-test etc. A p-value <0.05 was accepted as significant.

Results: The mean serum Triglyceride (TG) levels in Group B {Group B1 (266±22.2) and B2 (253.17±21.56)}, Low-density Lipoprotein Cholesterol (LDL-C) levels {Group B1 (134.60±11.32) and B2 (149.30±11.78)} and Very Low-density Lipoprotein Cholesterol (VLDL-C) levels in Group B {Group B1 (49.83±11.76) and B2 (50.16±5.42)} were higher than that in Group A {203±11.9, 124.89±8.11 and 34.94±5.95 respectively} and mean serum High-density Lipoprotein Cholesterol (HDL-C) levels in Group B {Group B1 (45.10±5.92) and B2 (44.90±8.31)} were lower than Group A {58.92±5.95 i.e., Hypertensive pregnant women (Group B) as compared to normotensive pregnant women (Group A)}.

Conclusion: This study concludes that serum lipid profile can be added as a marker of severity of PIH.

Keywords: Eclampsia, Pre-eclampsia, Serum lipid profile, Toxemia in pregnancy

INTRODUCTION

Hypertension during pregnancy is a major health problem. Pre-eclampsia is characterised by hypertension, oedema and proteinuria [1]. The proteinuria develops after twentieth week of gestation and appears with increasing frequency as pregnancy progresses. Pre-eclampsia with convulsions is termed as eclampsia and this may occur antepartum, intrapartum or postpartum. Both these conditions may adversely affect the foetus (by intrauterine growth retardation) and the mother (by vascular dysfunctions). Pre-eclampsia is one of the most common complications of pregnancy and is a leading cause of maternal and foetal morbidity and mortality. Pre-eclampsia occurs in 7-10% of pregnancies worldwide [2]. The incidence in India is reported to be 8-10% of pregnancies.

Amongst the various aetiologies of pre-eclampsia many are still unknown but the utero-placental ischaemia, genetic hypothesis, the immune maladaptation and hypothesis of imbalance between free radicals and antioxidants are some of the accepted ones [3]. In PIH the blood lipid value changes more with gestational age as compared to normal pregnancy. In cases of pre-eclampsia and eclampsia; signs and symptoms of hypertension and proteinuria are mainly due to disorders of lipoprotein metabolism [3]. Oxidative stress and vascular dysfunction also lead to abnormal lipid values in these cases. The cause and nature of these disorders are only incompletely understood. Therefore; a comparative study of serum lipid profile was carried out to assess serum lipid concentration in normotensive pregnancy and hypertensive pregnancy to study metabolic biomarkers, and to explore the possibility of serum lipid profile as a marker of severity of PIH.

MATERIALS AND METHODS

The present study was carried out on hypertensive (toxemic) pregnant women (cases) and normotensive pregnant (controls) women as a case-control study. Total 120 pregnant women attending or admitted at Obstetrics and Gynaecology departments of the two hospitals were selected and followed up till delivery. Inclusion of 40 normotensive pregnant women and 40 hypertensive pregnant women were selected from Government Hospital, Aurangabad, Maharashtra, India during the period of December 1997 to December 1998 and study was further extended to Sri Aurobindo Medical College and Postgraduate Institute, Indore, Madhya Pradesh, India from August 2014 to March 2015 with inclusion of 20 normotensive pregnant women and 20 hypertensive pregnant women. The age of pregnant women was ranging between 19-35 years and gestational age ranging between ≥28 weeks to term. The clinical details and history of all the pregnant women were recorded appropriately. Blood pressure and weight were recorded at every visit and at the time of admission in the hospital. Hypertension is defined as blood pressure ≥140/90 mmHg confirmed by two measurements at six hours apart as per gold standard criteria [4]. The pre-eclamptic women (hypertensive) were diagnosed by persistent hypertension ≥140/90 mmHg confirmed by two measurements, gross proteinuria (≥300 mg/dL) and pathological oedema [5]. Eclamptic women were diagnosed by the additional features of convulsions or coma.

Inclusion criteria were primipara 60% and multipara 40% at the third trimester of pregnancy and gestational age ≥28 weeks of gestation (the third trimester) and exclusion criteria included pre-existing hypertension, diabetes mellitus, any drug history influencing blood lipid levels and hypercholesterolemia.

Urine sample of each women were taken and it was tested (semi quantitatively) for urinary proteins by uristix method [7]. Results were interpreted as follows:

- +1 indicates urinary protein level 30 mg/dL
- +2 indicates urinary protein level 100 mg/dL
- +3 indicates urinary protein level 300 mg/dL
- +4 indicates urinary protein level over 2000 mg/dL

Women with absent urinary proteins were grouped as A (controls – 60 normotensive pregnant women) while women with urinary protein levels ranged from +1 to +4 were grouped as B (cases – 60 hypertensive pregnant women). Group B was further subdivided into B1 and B2. Group B1 was Pre-eclamptic (hypertensive) pregnant women (40 pregnant women) and Group B2 eclamptic (hypertensive) pregnant women (20 pregnant women).

No ethical approval was required for conducting the study as it was a sample based study and part of the routine clinical investigation.

The morning blood sample (5 mL) was obtained after 10 hours of fasting drawn by aseptic precautions in the vacutainer and it was sent to Clinical Biochemistry laboratory for serum analysis. Each serum sample from different groups was evaluated for the following biochemical parameters using ERBA chem-5 semi-automated analyzer and diagnostic kits (enzymatic kits):

- Serum TG (mg/dL) by GPO-PAP method.
- Total Cholesterol (TC) (mg/dL) by CHOD-PAP method.
- HDL-C (mg/dL) by CHOD-PAP method.

Following parameters were calculated using Friedewald formula [6]:

- LDL-C (mg/dL)
- VLDL-C (mg/dL)

STATISTICAL ANALYSIS

Data was subjected to statistical analysis using mean, standard error and student's t-test etc. A p-value <0.05 was accepted as significant.

RESULTS

[Table/Fig-1] showed that the study group was divided into two Groups as Group A (n=60) and Group B (n=60) and p-value <0.05 is statistically significant as compared to normal control.

Blood pressure has been confirmed by two measurements at 6 hours apart as per gold standard criteria.

[Table/Fig-2] showed that serum TG levels were significantly increased in Group B1 (266±22.2) and B2 (253.17±21.56) than Group A (203±11.9). In present study, no significant alteration was seen in serum TC levels in all groups. Serum HDL-C levels in hypertensive pregnant women of Group B1 (45.1±5.92) and B2 (44.9±8.31) were significantly lower than normotensive pregnant women Group A (58.92±5.95). Serum LDL-C levels were increased significantly in hypertensive women B2 (149.3±11.78) than normotensive women Group A (124.89±8.11). Serum VLDL-C levels were increased significantly in hypertensive women of Group B1 (49.83±11.76) and B2 (50.16±5.42) than normotensive women Group A (34.94±5.95).

[Table/Fig-3] showed the lipid parameter ratio in normotensive and hypertensive pregnancy (pre-eclamptic and eclamptic) in the third trimester between the different lipids LDL-C:HDL-C; TC:HDL-C; TG:HDL-C and HDL-C:VLDL-C. Results showed significant fall in HDLC: VLDL-C in pre-eclamptic and eclamptic pregnant women as compared to normotensive pregnant women. LDL-C:HDL-C ratio, TC:HDL-C ratio and TG:HDL-C ratio were significantly raised in pre-eclamptic and eclamptic pregnant women as compared to normotensive pregnant women.

A p-value <0.01 in Group B1 and Group B2 as compared to Group A were statistically very significant.

Parameter	Normotensive Group A (control) (n=60)	Hypertensive Group B (n=60)
Maternal age (year) mean±SD	20.90±0.92	20.17±0.98
Systolic BP (mmHg) mean±SD	110.60±2.43	158±2.57*
Diastolic BP (mmHg) mean±SD	78±0.88	110.62±1.38*

[Table/Fig-1]: Clinical characteristics of normotensive and hypertensive pregnant women.
SD=Standard Deviation.

Parameters	Group A (n=60)	Group B1 (n=40)	Group B2 (n=20)	Statistical relation with Group A
Triglyceride (TG)	203±11.9 (164-241)	266±22.2* (202-318)	253.17±21.56* (188-312)	p<0.05 in group B1 and B2
Total Cholesterol (TC)	219.12±15.64 (166-236)	230.21±16.92 (194-252)	243.18±17.12 (190-262)	p>0.05 in group B1 and B2
HDL-Cholesterol	58.92±5.95 (42-68)	45.1±5.92* (38-64)	44.9±8.31* (31-60)	p<0.01 in group B1and B2
LDL-Cholesterol	124.89±8.11 (98-136)	134.6±11.32 (108-160)	149.3±11.78* (110-162)	p<0.05 in group B2
VLDL-Cholesterol	34.94±5.95 (25-42)	49.83±11.76* (37-62)	50.16±5.42* (39-61)	p<0.05 in group B1 and B2

[Table/Fig-2]: Serum lipid levels in normotensive and hypertensive pregnant women in the third trimester.
All the parameters in the tables are expressed in mean±SD and ranges within parenthesis.
*=Significant value; n=Number; SD=Standard Deviation

DISCUSSION

Some previous researches showed that profound change in the lipid profile of normotensive pregnant women is observed in the third trimester of pregnancy as high as two folds in non-pregnant women [8]. The oestrogen hormone induces hepatic synthesis of endogenous TGs in normotensive pregnancy, which is carried by VLDL [9].

The results obtained in the present study show that serum TG levels were increased significantly (p<0.05) in hypertensive pregnant women which corroborated with the findings of many researchers [10]. It is possible that this difference might be associated with hyperoestrogenaemia causing endogeneous TG synthesis. This increased TG is likely to be deposited in uterine spiral arteries which contribute to the endothelial dysfunction generating small and dense LDL particles deposited in the vessels [11]. In eclampsia there is aggravated hepatic damage which further inhibits the enhanced de novo synthesis of TG in the liver. This hypothesis coincided with our study.

Our findings were similar to the work of Sattar N et al., [11]; during their work they also found no significant increase in serum TC in the third trimester of normotensive pregnant women and hypertensive pregnant women. While some others have found significant increase in serum TC in hypertensive pregnant women than normotensive pregnant women [12,13].

	Group A (n=60)	Group B1 (n=40) (Pre-eclamptic)	Group B2 (n=20) (Eclamptic)	Statistical relation with Group A
	(Normotensive)	(Hypertensive)		
LDL-C : HDL-C ratio	2.11±1.36	2.98±1.91*	3.32±1.41*	p<0.001 in group B1 and B2
TC : HDL-C ratio	3.71±2.62	5.10±2.85*	5.41±2.06*	p<0.01 in group B1 and B2
TG : HDL-C ratio	3.44±2	5.89±3.73*	5.63±2.59*	p<0.0001 in group B1 and B2
HDL-C : VLDL-C ratio	1.68±0.01	0.90±0.14*	0.89±1.53*	p<0.0001 in group B1 and B2

[Table/Fig-3]: Cardiovascular risk indices in normotensive and hypertensive pregnancy (Pre-eclamptic and Eclamptic) in the third trimester.
All the parameters in the tables are expressed in mean±SD.
n = Number; SD = Standard Deviation; * = Significant value

Physiological hypercholesterolemia and hypertriglyceridemia were observed in the present study. In normotensive pregnancy growth and structural development and availability of lipids may promote lactation later [14].

In our study, serum LDL cholesterol level showed highly significant ($p<0.05$) increase in hypertensive pregnant women than normotensive pregnant women. Thus, it coincides with the observations of Hubel CA et al., [12,13]. Serum LDL cholesterol level was increased in hypertensive pregnant women and this may be because of significant increase in the levels of beta-lipoproteins in hypertensive women in the third trimester of pregnancy.

Our study also revealed decreased serum HDL cholesterol level in hypertensive pregnant women than normotensive pregnant women. These findings were corroborated with findings of Sattar N et al., [11].

In present study, serum VLDL cholesterol level was significantly increased ($p<0.05$) in hypertensive pregnant women than normotensive pregnant women which may be due to enhanced entry of VLDL in to the blood circulation as it carries endogenous TG along with it. It was due to increased VLDL, synthesis causes VLDL accumulation in vascular endothelium damaging uterine and renal vessels [15].

Studies conducted by some other workers Kaloti AS et al., and Latha DP and Ganesan D also showed that there is significant association of TG, VLDL and HDL levels among PIH cases ($p<0.05$) than normal [16,17].

We have also calculated the ratios between different lipids LDL-C:HDL-C; TC:HDL-C; TG:HDL-C and HDL-C:VLDL-C. In the present study there was a significant fall in HDLC:VLDL-C in pre-eclamptic and eclamptic pregnant women as compared to normotensive pregnant women and LDL-C:HDL-C ratio, TC:HDL-C ratio and TG:HDL-C ratio were significantly raised in pre-eclamptic and eclamptic pregnant women as compared to normotensive pregnant women as also reported by other studies [10,18,19].

The results of our study, when taken together with those of earlier studies indicate that hypertriglyceridemia and hyperlipoproteinemia, precede the clinical manifestations of pre-eclampsia. Thus, it can be concluded that dyslipidaemia may be of aetiologic and pathophysiologic importance in this relatively common complication of pregnancy (i.e., PIH).

LIMITATION

Patients having personal history suggestive of hypertension, diabetes mellitus, any drug history influencing blood lipid levels and hypercholesterolemia were not included in the study so the study findings are limited to this specific population.

CONCLUSION

After analysing the results of this study; we have observed that hyperlipidemia is profound and significantly evident in hypertensive (pre-eclamptic and eclamptic) pregnant women than normotensive pregnant women in the third trimester. It plays an important pathophysiological role as a risk marker; so, it must not be underestimated. The various causative factors for hyperlipidemia and its prevention need further evaluation and studies to manage therapy to reduce maternal morbidity and mortality and to improve foetal outcome. Intrauterine Growth Retardation (IUGR) and chronic foetal distress due to hyperlipidemia and hyperlipoproteinemia can be prevented; if serum lipid levels are monitored.

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