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Original Research Article

Study of serum lipid profile and magnesium in preeclampsia

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ABSTRACT

Background: A comparative study of serum lipid profile and magnesium levels in normal pregnancy versus preeclampsia (PE).

Methods: A prospective study done for 2 years (October 2014 to October 2016) in the Department of Obstetrics and Gynecology, Narayana medical college and hospital, a tertiary care centre, Nellore, Andhra Pradesh, India. A sample size of 200 pregnant women, recruited and divided into group A and B. group A being women with PE and group B is normal pregnant women. 10ml of venous blood was collected in the fasting state and serum collected from clotted blood to measure lipid profile, magnesium, Apo lipoprotein A-I and Apo lipoprotein B 100. Serum Lipid profile measured by enzymatic method using commercially available kit Human (GmbH Germany) using humastar 600 chemistry analyzer (Human GmbH Germany). Serum magnesium measured by dye binding method using commercially available kit Human (GmbH Germany) using Humastar 600 chemistry analyzer (Human GmbH Germany). Serum ApoA-I and ApoB were measured by immune-turbidometry using commercial kits from Spinreact Spain. Urine albumin done by dipstick method.

Results: Serum total cholesterol (TC), Triglyceride (TG), low density lipoprotein (LDL), very low-density lipoprotein (VLDL), Apo lipoprotein B 100 (Apo B100) were high and serum Magnesium, high density lipoprotein (HDL) and Apo lipoprotein A1 (Apo A1) were low in the study group (group A) compared to controls (group B).

Conclusions: Abnormal lipid profile (low HDL and increased TG concentration) and serum hypomagnesaemia may be contributing etiologies of preeclampsia, having good predictive value as a screening procedure for PE in high risk pregnant population.

Keywords: High density lipoprotein, Lipid profile, Preeclampsia-serum lipids-magnesium, Serum total cholesterol

INTRODUCTION

Hypertension during pregnancy is one of the leading causes of maternal and perinatal morbidity and mortality.¹ It is a relatively common complication of pregnancy affecting 2-5% of women globally.² Preeclampsia in India ranges from 5% to 15%, contributing to 16% of maternal mortality and 20% of perinatal mortality with dreaded pregnancy complications viz eclampsia and cerebrovascular accidents. The

pathophysiology of preeclampsia is still unclear. However, studies have demonstrated an association with a cluster of metabolic abnormalities. According to epidemiological evidence women with previous gestational hypertension seem to be at increased risk of hypertension, cardiovascular disease, stroke and death from ischaemic heart disease in later life.¹

Several clinical and biochemical screening tests have been employed to determine women at risk of developing

this disease, but no single test can reliably predict the possibility of developing the disease in pregnancy.³ Since abnormal lipid metabolism seems important in the pathogenesis of preeclampsia, assessment of serum lipid profile in pregnant women at risk of this disease may suggest some new diagnostic or prognostic tools.

It is a well-known fact that electrolytes play an important role in the etiopathogenesis of hypertension. Magnesium has been established as an essential element for fetal well-being. Its deficiency during pregnancy has been reported to be associated with pre-eclampsia, eclampsia, preterm birth and intra uterine growth restriction.^{4,5}

Magnesium modulates the cardiovascular effect of sodium and potassium and it is the co-factor for the sodium potassium ATPase activity. Since it contributes significantly in the functioning of the vascular smooth muscles, the present study was designed to evaluate this electrolyte in preeclampsia.

The main objective of this study was to compare the lipid profile and serum magnesium in preeclamptic and normal pregnant women. Moreover, the hormonal imbalance is a prime factor for the etiopathogenesis of PE and this endocrinal imbalance is well reflected in alteration of serum lipid profile. Therefore, simple measurements of serum lipid parameters may be of good predictive value in toxemia of pregnancy, avoiding the costly investigations.

METHODS

A prospective study done in the Department of Obstetrics and Gynaecology, Narayana medical college and Hospital, Nellore for a period of 2 years.

This study was designed to look for any differences of serum lipid profile and serum magnesium levels in preeclampsia and in normal pregnancy.

A sample size of 200 women divided into 2 groups, 100 in each group were recruited. Group A being women with PE and group B is normal pregnant women. Institutional ethical committee clearance and informed consent of all the recruited population was obtained.

Inclusion criteria

- Pregnant women aged 18-35 years with BP $\geq 140/90$ mm Hg and gestational age above 20 weeks with proteinuria were recruited as study population along with age and parity matched normal pregnant women as controls.

Exclusion criteria

- Women who were having pre-existing hypertension, renal disease and previous history of convulsions were excluded.

All the women in the study were evaluated with detailed history, complete systemic and obstetric examination. Apart from routine antenatal investigations, serum magnesium levels and serum lipid profile (serum cholesterol, serum triglycerides, serum VLDL, serum LDL, serum HDL, serum apolipoprotein B100 and serum apolipoprotein A1) was done for all the women. In the fasting state with 10ml of venous blood being collected, allowed to clot to obtain the serum.

Serum lipid profile (total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides) was measured by enzymatic method using commercially available kit Human (GmbH Germany) using Humastar 600 chemistry analyzer (Human GmbH Germany). Serum magnesium measured by dye binding method using commercially available kit Human (GmbH Germany) using Humastar 600 chemistry analyzer (Human GmbH Germany). Serum ApoA-I and ApoB were measured by immunoturbidometry using commercial kits from spin react Spain. Urine albumin was done by dipstick method.

RESULTS

A total of 200 pregnant women were recruited into the study and divided into A and B groups. Group A constitutes the study population (preeclamptic women) and group B the controls (normal pregnant women). The age and mean gestational age were closely matching in both the groups.

Table 1: Age distribution-study group versus controls.

Age	Study group	Control group
18-22	38	42
23-27	46	46
28-32	11	10
>32	5	2

Present study showed that there was no significant difference in the mean age of study and control groups. The mean age of study group being 23.97 ± 4.32 years and that of controls was 23.84 ± 3.34 years (Table 1). In study group 53 were primigravidae and 47 were multiparous women whereas in controls the corresponding figures are 28 and 72 (Table 2).

Table 2: Parity-study group versus controls.

Gravida	Study group	Control group	Total
Primi gravida	53	28	81
Multi gravida	47	72	119

There was a significant difference in the mean arterial pressures between study and control groups with significant P value (Table 3).

Table 3: Mean arterial pressure (MAP)-study group versus controls.

	Study group	Control group	p value
MAP (mm of Hg)	153.2±14.793	110.67±7.77	<0.0001

Albuminuria was found in the entire study group-32 women had 1±27 women had 2±18 women had 3±and 23 women had traces whereas the corresponding figures in the controls being 2,3,0,1 respectively and 94 with no albuminuria at all (Table 4).

Serum total cholesterol, triglycerides, low density lipoproteins, very low-density lipoproteins, and Apo lipoprotein B 100 were high in the study group compared to controls with significant p value (Table 5). Serum magnesium, high density lipoproteins and Apo lipoprotein A1 were found to be low in the study group

compared to controls with the p values being significant (Table 5).

Table 4: Urine albumin-study group versus controls.

Urine albumin	Study group	Control group
NIL	0	94
TRACES	23	1
1+	32	2
2+	27	3
3+	18	0

Table 5: Mean values of lipid profile-study versus controls and mean values of serum magnesium and lipid profile-study versus controls.

Parameter	Study group	Control group	p value
S. TC (mg/dl)	208.11±8.987	164.12±4.482	<0.0001
S. TG (mg/dl)	204.4±8.865	153.05±12.245	<0.0001
S. LDL-C (mg/dl)	142.48±6.295	114.4±7.897	<0.0001
S. VLDL-C (mg/dl)	52.05±4.384	36.04±1.922	<0.0001
APO B100 (mg/dl)	48.34±9.83	37.67±4.57	<0.0001
S. Mg (mg/dl)	1.39±1.46	2.09±2.01	<0.0001
S. HDL-C (mg/dl)	37.99±2.393	49.21±2.840	<0.0001
Apo Lipoprotein A1 (mg/dl)	132.26±11.58	170.56±16.33	<0.0001

DISCUSSION

Preeclampsia continues to be a major obstetric problem in present-day healthcare practice. It affects not only maternal health but also puts the fetus at risk. In women with PE, free fatty acids especially linolenic acid and TG concentrations are elevated in blood which is found to be increased even before 20 weeks of gestation and thus predicts PE.⁶ In endothelial cells oxidative stress is stimulated by linolenic acid causing excessive lipid peroxidation and thereby decreasing antioxidant activity, which may result in an imbalance between peroxidases

and antioxidants. Several investigators have hypothesized that the disordered lipid profile and oxidative stress in endothelial cell is of major importance to the pathophysiology of preeclampsia.⁷

Maternal age is one of the essential risk factors in changing lipid metabolism in women with preeclampsia. As per the study of Sajith M et al, maximum number of women were seen in age group of 18-22 years (40.5%) with least number being in the group of more than 32 years (2.7%).⁸ In the present study majority of women were seen in the age group of 23-27 years (Table 6).

Table 6: Age distribution of preeclamptic women.

Study	18-22years n/ %	23-27years n/ %	28-32years n/ %	>32years n/ %
Sajith M et al ⁸	30/ 40.5	28 / 37.8	14/18.9	2 / 2.7
Present study	38/38	46/46	11/11	5/5

They were found to be career oriented and got married late which could be the cause for higher percentage in this age group. It is a well-known fact that primiparity almost triples the risk for preeclampsia. The above studies show that more Primigravidae were Preeclamptic compared to multigravidae. Present study results were also in par with above. Among multigravidae the parity of 74.4% of women was 2 and the rest 25.5% were of higher parity thus proving the risk of developing PE gets reduced as parity increases (Table 7).

Table 7: Parity distribution of preeclamptic women.

Study	Primigravida	Multigravida
Prakash J et al ⁹	20	12
Sajith M et al ⁸	38	36
Present study	53	47

The major modulator of hypertriglyceridemia is oestrogen as pregnancy is linked with hyper oestrogenaemia. Oestrogen induces hepatic biosynthesis of endogenous triglycerides, which is carried by hepatic VLDL into the circulation.¹⁰ In PE, increased Triglycerides are found to be deposited in predisposed vessels, such as uterine spiral arteries leading to endothelial dysfunction. In studies done by Jayanta De et al, Islam NAF et al and Nazil R et al, it is found that the mean serum TG, serum total cholesterol, low density lipoproteins and Apo protein B 100 values were high where as that of HDL and Apo protein A1 were low in study group compared to control group which was statistically significant. The present study results are also found to have the same pattern (Table 8 and 9). But in the study by Nazil R et al there was not found much difference in LDL levels in both study and control groups.

Table 8: Comparative studies of lipid profile in pre-eclampsia.

Study	Serum triglycerides (mg/Dl)- mean values		Serum total cholesterol (mg/dl)- mean values		Serum high density lipoproteins (mg/Dl)- mean values		Serum low density lipoproteins (mg/Dl)- mean values	
	Study group	Control group	Study group	Control group	Study group	Control group	Study group	Control group
Jayanta D et al ¹¹	275.6±38.93	215.6±38.96	236.3±35.63	219.0±16.6	45.9±8.00	60.7±8.11	135.4±23.36	114.2±11.32
Islam NAF et al ¹²	225.6±28.93	165.6±17.22	186.3±34.43	169.1±7.03	42.4±9.29	55.7±7.11	134.4±24.26	115.2±10.72
Nazli R et al ¹³	259.05±10.0	212.3±7.28	209.76±5.59	202.23±4.6	45.98±1.08	52.2±1.14	111.3±5.26	107.4±4.07
Present study	204.4±8.865	153.05±12.24	208.11±8.98	164.12±4.482	37.99±2.393	49.21±2.840	142.48±6.29	114.4±7.897

Table 9: Comparative studies of serum Apo Lipo A1 and Apo B1 in study and control groups.

Study	Serum Apo Lipo A1 (mg/Dl)- mean values		Serum Apo B100 (mg/Dl)-mean values	
	Study group	Control group	Study group	Control group
Nazli R et al ¹³	177.86±5.67	190.14±5.31	120.06±4.32	128.33±5.50
Present study	132.26±11.58	170.56±16.33	48.3±9.83	37.67±4.57

Table 10: Lipid profile ratios-study versus controls.

Study	Serum LDL/HDL ratio		Serum TC/HDL ratio		Serum TG/HDL ratio		Serum HDL/VLDL ratio	
	Study group	Control group	Study group	Control group	Study group	Control group	Study group	Control group
Jayanta D et al ¹¹	2.89±0.50	1.72±0.62	5.19±0.56	3.64±0.35	6.09±1.01	3.6 ±0.51	0.84±0.12	1.42 ±0.22
Nazli R et al ¹³	2.76±0.16	2.07±0.29	5.38± 0.19	3.95± 0.36	8.38±0.5	4.41±0.43	0.72±0.03	1.3 ±0.09
Present study	3.76±0.29	2.33±0.24	5.5 ±0.46	3.34 ±0.21	5.4±0.45	3.11±0.29	0.74±0.084	1.37±0.102

The ratios of lipid profiles have also been calculated (TC/HDL, TG/HDL, LDL/HDL and HDL/ VLDL) in the present study. The values of these lipid profile ratios

followed the same pattern as individual lipid levels (Table 10). The ratios of LDL/HDL, TC/HDL, TG/HDL are found higher and HDL/ VLDL ratio are found lower

in study group compared to controls as expected. Though the association of these ratios in pregnancy and PE is yet to be recognized, the significance of altered TC/HDL, TG/HDL, LDL/HDL and HDL/ VLDL ratios cannot be ignored as they point towards more threat of PE.

Serum magnesium

Pregnancy is a state of magnesium depletion. The total and ionized magnesium levels are significantly lower in normal pregnancy compared to non-pregnant women.^{14,15} The levels tend to fall during pregnancy and further decrease in women who develop preeclampsia later.¹⁵ The utilization of magnesium during pregnancy exceeds the intake creating a state of physiological hypomagnesemia.¹⁶ Serum magnesium progressively declines during pregnancy reaching a nadir at 34 weeks and then rises up to term.¹⁷ Statistically significant fall in serum magnesium has been observed in pre-eclampsia and with remarkable reduction in eclampsia.¹⁸ In study done by Indumathi V et al, serum magnesium decreased in the study group when compared to control group which was significant. But in the study by Deepa V et al, Kanagal serum magnesium levels were not significantly altered in both the groups. In present study the serum Magnesium levels were found to show a downward trend in preeclamptic compared to controls which was significant (Table 11).

Table 11: Serum magnesium levels-study versus controls.

Study	Serum magnesium (mg/Dl)		P value
	Study group	Control group	
Indumathi V et al ¹⁹	1.35±0.17	2.63±0.22	<0.0001
Kanagal DV et al ²⁰	1.43±0.55	1.57±0.72	NS
Present study	1.39±0.146	2.09±0.201	<0.0001

CONCLUSION

Abnormal lipid metabolism predominantly low HDL-C and high TG concentrations increase the vascular dysfunction and oxidative stress seen in PE. Hence the serum lipid profile has to be done during antenatal care as it is very helpful in early detection and treatment of hypertensive disorders amongst pregnant population. The decreased serum magnesium level is one of the predictors for the development of PE in pregnant women. Hence screening of all the high-risk antenatal population for serum dyslipidemia and hypomagnesemia may help in predicting and reducing the development of later complications of Preeclampsia.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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