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Original Research Article

Assessment of maternal lipid profile in early pregnancy and its correlation with pregnancy outcome

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ABSTRACT

Background: Lipoprotein lipid physiology in pregnancy has important implications for the developing fetus as well as the mother. Elevated maternal triglycerides levels measured during early pregnancy have been associated with adverse pregnancy outcomes affecting both maternal and fetal health.
Methods: This was a prospective observational study conducted in the Department of Obstetrics and Gynecology, GSVM Medical College Kanpur between January 2020 to October 2021. A total of 146 antenatal women were enrolled in this study, out of which 26 women were lost to follow-up. Lipid profile was done for each subject and was later accessed.
Results: Total cholesterol were deranged in patients 30%, serum TG in 40.83%, LDL in 28.33%, HDL in 35.83%. Out of total of 120 patients, 18 (15%) patients had HDP, 6 (5%) had GDM, 13 (10.83%) had a preterm delivery, 14 (11.66%) had FGR 9 (15.83%) had SGA babies, 7 (5.83%) had LGA babies and 38 (31.66%) patients delivered by cesarean section. In this study, only 15% of the study population shows hypertensive disorder of pregnancy and had a statistically significant correlation with triglyceride level.10.83% of the study population had preterm delivery. It showed a statistically significant correlation with serum TG level.
Conclusions: Estimation of serum lipid profile during pregnancy can be considered as an early and economical investigation to prevent the deleterious effects of hyperlipidaemia associated with pregnancy.

Keywords: Lipoprotein Lipid physiology, Pregnancy

INTRODUCTION

There has been a tremendous improvement in antenatal care and coverage all around the world during the past few decades but still the maternal and neonatal morbidity and mortality in developing country is high.[1]

Hypertensive disorders of pregnancy, gestational diabetes mellitus, and preterm deliveries are among the leading causes of fetal and maternal morbidity and mortality.[2] Lipoprotein lipid physiology in pregnancy has important implications for the developing fetus as well as the mother. Pregnancy not only demands more metabolic fuels but also causes an alteration in hormonal levels, which may cause few changes in lipid profile during pregnancy. Pregnant women will develop peripheral insulin resistance and alteration of hormones, those directly involved in the lipid metabolism such as leptin and insulin are higher than the nonpregnant state. Overall, the changes in lipid physiology throughout the course of pregnancy allow for a continuous supply of proper nutrients for the fetus and they reflect increasing insulin resistance in the mother.

Elevated maternal triglycerides levels measured during early pregnancy are associated with adverse pregnancy outcomes affecting both maternal and fetal health

namely[3-4] 1) Hypertensive disorders of pregnancy (HDP), 2) Gestational diabetes mellitus (GDM), 3) Preterm birth (PTB), 4) Small/Large for gestational age (SGA/LGA) and 5) Stillbirth/IUD. There is also developing research indicating that in utero environment influences susceptibility to chronic diseases later in life, a concept known as "developmental programming.

Therefore, the present study was designed to evaluate the effect of maternal lipid profile (cholesterol, TC, TG, LDL, and HDL) during early pregnancy and its association with the fetomaternal outcome.[2] The study may prove to be useful as maternal lipid levels can be easily measured in all clinical laboratories with routine, well-established lipid panels: thus, the lipid panels could serve as a cost-effective method for identifying pregnant women at risk. These can be used as a "powerful predictive tool" for obstetricians for early and expert management identification of high-risk pregnancies.[1]

METHODS

The present study was conducted in the Department of Obstetrics and Gynecology, in collaboration with the Department of Pathology and LPS Institute of Cardiology, GSVM Medical College, Kanpur. The study was carried out over a period of 2 years from January 2020 to October 2021. It was a prospective observational study. 146 antenatal women were enrolled after taking written and informed consent, out of which 26 women were lost to follow-up.

Inclusion criteria

All primigravidas with singleton pregnancy at gestational age from 13-20 weeks, were included in the study.

Exclusion criteria

Women with any of the following conditions were excluded Multiple pregnancies Molar pregnancy: Chronic hypertension, diabetes mellitus, Grade III and Grade IV heart disease, chronic renal failure, liver disease, history of smoking, treatment with drugs that may influence the lipid profile e.g. antiepileptic drugs, steroids, insulin, antidepressants, thyroid hormones, sleep medication. History of prior medical illness, any endocrinal disorder, BMI >25.

Venous blood from the antecubital vein was withdrawn under aseptic conditions after an 8-12 hours fasting period and patients were classified depending upon serum lipid level according to the National Cholesterol Education Program (NCEP) guidelines.[10]

Statistical analysis

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 20 (IBM SPSS Statistics). The data were presented using frequencies, percentages, and descriptive statistics followed by charts and graphs. The level of significance was set at 5%. All p-values less than 0.05 were treated as significant.

Table 1: Study of cholesterol.

Total cholesterol	Triglyc-eride	HDL	LDL
<200: Desirable	150-199: borderline high	<40: low	<100: optimal
200-239: borderline high	200-499: high	40-60: normal	100-129: near optimal
≥240: High	≥500: very high	>60: high	130-159: borderline high
			160-189: high

RESULTS

A total of 120 antenatal women with a singleton pregnancy between 13 to 20 weeks of gestation were analyzed. The maximum no. of subjects i.e., 50 (41%) belonged to the age group of 26-30 years (Table 2).

Table 2: Distribution of study population.

Distribution of study population according to age (n=120)			
Age (years)	**N**	**Percentage (%)**	
<20	16	13	
21-25	43	36	
26-30	50	42	
31-34	11	9	
Distribution of study population according to BMI			
BMI	**N**	**Percentage (%)**	**Mean±std. deviation**
Underweight	42	35	17.56±0.84
Normal	78	65	21.66±1.72
Gestational age at delivery			
Gestational age	**N**	**Percentage (%)**	**Mean±std. deviation**
Preterm (<37weeks)	13	11	33.0±2.50
Term (37-40weeks)	100	83	38.5±1.50
Postdated (>40weeks)	7	6	40.5±1.50
Distribution of study population according to the mode of delivery			
Mode of delivery	**N**	**Percentage (%)**	
LSCS	38	32	
NVD	82	68	

The majority of patients (66%) enrolled in our study belonged to the middle socioeconomic group Mean age of the study population was 25.50±3.50 years. The mean

gestational age of patients delivered before 37 weeks was (33±2.50), between 37 to 40 weeks was (38.5±1.50) and after 40 weeks was (40.5±1.50). 38 patients were delivered by cesarean section and 82 patients had a normal vaginal delivery. Mean birth weight of babies delivered appropriate for gestational age (2.5-3.5kgs) was 3.12±0.85, LGA (3.5kgs) was 3.75±0.95, and SGA (<2.5 kgs) was 2.22±0.35.

The mean values of lipid profile were as follows: total cholesterol (189.15±35.87mg/dl), triglyceride (163.42±47.81mg/dl), LDL (118.56±35.49mg/dl), HDL (55.05±14.50mg/dl).

The total cholesterol was deranged in 36 patients (30%), serum TG in 49 patients (40.83%), LDL in 34 patients (28.33%), HDL in 43 patients (35.83%).

Out of a total of 120 patients, 18 (15%) patients had HDP, 6 (5%) had GDM, 13 (10.83%) had a preterm delivery, 14 (11.66%) had FGR, 19 (15.83%) had SGAbabies, 7 (5.83%) had LGA babies and 38 (31.66%) patients delivered by caesarean section.

In our study, only 15% of the study population shows hypertensive disorder of pregnancy and had a statistically significant correlation with triglyceride level but not with total cholesterol, LDL, and HDL.

GDM developed in 5% of the study population. There was no significant statistical significance observed between lipid level and GDM.

Total 10.83% of the study population had preterm delivery. It showed a statistically significant correlation with serum TG level but not with other lipid parameters.

In our study, 15.83% of patients had FGR but had no statistically significant correlation with any of the parameters of the lipid profile.

Other outcome measures like mode of delivery and birth weight had no significant correlation with lipid profile.

The mean BMI (Mean±SD) was (17.56±0.84) in the underweight category and (21.66±1.72) in the normal category. The mean gestational age (Mean±SD) of patients delivered before 37 weeks was (33±2.50), between 37 to 40 weeks was (38.5±1.50) and after 40 weeks was (40.5±1.50).

In this study, the mean level of total cholesterol was (189.16±35.87mg/dl). Out of 120 pregnant women total cholesterol was normal (<200mg/dl) in 84 and deranged (≥200 mg/dl) in 36 patients. The association of total cholesterol level with pregnancy outcome and the perinatal outcome was not statistically significant.

In this study mean triglyceride level was (163.46±47.81mg/dl). Out of 120 pregnant women, TG level was normal (<150mg/dl) in 71 and deranged (≥150mg/dl) in 49 patients, out of which 4 patients had GDM, 10 patients had SGA babies, 4 patients had LGA babies and 16 patients delivered by caesarean section. The association of serum TG with pregnancy outcome and the perinatal outcome was statistically insignificant (Table 3).

Table 3: Association between the serum triglyceride and HDP.

Triglyceride	HDP Yes	HDP No	Total	Chi squared value	P-value
Normal	7	64	71	x^2=3.604	P=0.02882
Deranged	11	38	49	Significant	P<0.05
	18	102	120		

Table 4: Association between the serum triglyceride and preterm delivery.

Triglyceride	Preterm delivery	Term delivery	Post-term	Total	Chi-square value	P-value
Normal	2	64	5	71	x^2=11.72	P=0.002856
Deranged	11	36	2	49	Significant	P<0.001
	13	87		120		

During this study, 120 pregnant women were included of which 49 patients had deranged triglyceride, and 11 patients had HDP. Since P-value is less than 0.05. Therefore, this result was statistically significant (Table 4).

In this study, 49 patients had elevated serum TG, out of which 11 patients had preterm delivery and 36 patients had a delivery at term. Since the p-value comes to less than 0.05 therefore the result is statistically significant. The HDL values and pregnancy outcomes were analyzed and found to have statistically insignificant results.

DISCUSSION

Pregnancy is a condition which is associated with hyperestrogenemia, the principal modulator of hyperlipidaemia. Due to hypercholesterolemic oxidative stress and an elevated atherogenic index, atherosis would

be seen in the utero placental spiral arteries, this would lead to the decreased blood supply to the foetus that results in preeclampsia. In hyperlipidemia, especially the patients with raised BMI, the level of insulin resistance is high and would end up in gestational diabetes mellitus.

In our study, it was observed that the maximum no. of subjects i.e., 50(41%) belonged to the age group 26-30years. The maximum age limit in our study was 34 years. The mean age of the study population was 25.50±3.50 years. Deepti et al concluded in their study that total cholesterol, triglycerides, and low-density lipoprotein were found to be elevated in older age than the younger women.[18] The reason behind the elevation of lipid profile in the older age group was due to hormonal changes especially alteration in the estrogen metabolism. Shamai et al explained in their study that high BMI patients have elevated levels of total cholesterol and triglyceride levels.[25] High triglyceride levels were significantly associated with insulin resistance.

In our study, the mean level of total cholesterol was (189.16±35.87mg/dl). Among 120 pregnant women total cholesterol was deranged (≥ 200 mg/dl) in 36 patients. The association of total cholesterol level with pregnancy outcome and the perinatal outcome was not statistically significant. Similar results were also found in the study of Ghodke et al as no statistical significance observation between serum cholesterol and preeclampsia, GDM, and preterm in both second and third trimesters.[9] Nidhi et al stated that the mean level of total cholesterol in participants who developed preeclampsia was significantly higher as compared to the normotensive group.[1] The difference between the groups was statistically significant in their study.

Mean level of triglyceride was (163.46±47.81mg/dl). TGs levels were elevated in 49 patients. The association of serum TG with pregnancy outcome and perinatal outcome were analyzed statistically and there was a significant statistical correlation seen with hypertensive disorders of pregnancy and preterm delivery. There was no significant correlation observed with GDM, birth weight, and mode of delivery. Ghodke et al found similar results in their study and concluded that there was a significant statistical significance observed between serum triglyceride levels with preeclampsia and preterm in the second trimester.[9] Tanja et al stated that elevated triglyceride would result in GHT, preeclampsia, preterm delivery, and perinatal complications such as SGA/LGA.[2]

Mean LDL was calculated 118.56±35.50 mg/dl in the study. Serum LDL level was elevated in 34 patients. The association of serum LDL levels with HDP, preterm, mode of delivery, and birth weight were found statistically not significant. Nidhi et al found statistically significant association between LDL and HDP in their study.[1] The mean level of HDL was (55.06±14.5 mg/dl). Nidhi et al got similar results and found this association was statistically significant.[1] Kandimalla, et al reported that mean HDL-C levels were found to be lower in preeclampsia.[11]

In this study, lipid profile was done only in the 2nd trimester so the pregnancy outcome due to lipid abnormalities cannot be properly analyzed. Due to the outbreak of the Covid 19 pandemic, our hospital became a Covid dedicated hospital, owing to which eventually led to a small sample size, and therefore the conclusions drawn cannot be implemented in the general population.

CONCLUSION

In the present study, it was observed that maternal dyslipidaemia in the early second trimester may predispose to hypertensive disorders of pregnancy and preterm delivery. We conclude that the estimation of serum lipid profiles during pregnancy can be considered as an early and economical investigation and can be recommended as a part of the laboratory investigation to prompt management strategies to prevent the deleterious effects of hyperlipidaemia associated with pregnancy.

Hence certain lifestyle modifications are advisable as an integral part of postpartum counselling in women of reproductive age group to decrease the risk of noncommunicable diseases in later life such as hypertension, diabetes mellitus, and ischemic heart disease.

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