Section: Obstetrics and Gynaecology

Original Research Article

MATERNAL AND FETAL CORD BLOOD LIPIDS IN INTRAUTERINE GROWTH RESTRICTION

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Abstract

Background: Intrauterine growth restriction is when the fetus fails to achieve its genetic growth potential and is at risk of increased perinatal morbidity and mortality. The primary objectives are to study the incidence of hyperlipidaemia in mothers of IUGR newborns and the impact of cord blood lipid profiles in IUGR newborns. **Materials and Methods:** We included 50 pregnant women with IUGR who met the inclusion and exclusion criteria. After obtaining informed consent from patients, 4ml of blood was withdrawn from the patient in a fast at 34 to 40 weeks. The lipid profile was assessed by the enzymatic endpoint or cholesterol oxidase method. The advantage is only a smaller sample quantity is needed which is precise, specific, accurate, and more convenient than the conventional lipid assay. **Result:** 50 IUGR antenatal mothers were included, twenty-three patients were primi, and 27 were multigravida. Thirty-five patients were delivered before 37 weeks, and 15 were delivered after 37 weeks of gestation. Twenty-eight patients were delivered by Cesarean section, and 22 had a normal vaginal delivery. Four mothers have increased LDL levels which is nearly 8%. Eight have increased triglyceride levels by almost 16%, and 10 IUGR newborns have increased triglyceride levels by almost 20%. HDL decreased in 4 mothers, 8%, and nine newborns, nearly 18%. **Conclusion:** It is clearly understood that IUGR mothers have altered lipid profiles, indirectly affecting the fetus lipid metabolism. It is understood that there is some increase in the fetus's triglycerides and a decrease in HDL.

INTRODUCTION

Intrauterine growth restriction is when the fetus fails to achieve its genetic growth potential and is at risk of increased perinatal morbidity and mortality. The expressions retardation and restrictions were previously used interchangeably for this phenomenon. Still, restriction describes the condition more appropriately, as IUGR indicates a limitation rather than a delay in growth.[1-4]

Physical and metabolic adaptations mark pregnancy, and there will be an altered lipid metabolism and lipid profile status compared to pre-pregnancy. There is significant adipose tissue expansion, and hepatic lipid synthesis increases. Pregnant women will develop peripheral insulin resistance, and alteration of hormones directly involved in lipid metabolisms such as leptin and insulin are higher than the non-pregnant state. All serum lipid components progressively increase, some of them up to 2-fold. These changes are essential for adequate fetal development and growth. [5,6]

Fat is the body's major energy storage and contains a large source of fatty acids. The excessive fat is stored in the subcutaneous tissue, adipose tissue retroperitoneal spaces, and omentin. Cholesterol is essential for normal fetal development. It plays a key role in forming cell membranes, maintaining membrane integrity, and preserving cholesterol-rich domains essential for most membrane-associated signalling cascades, including sonic hedgehog signalling. It is also the precursor to many important hormones, such as steroids, vitamin D, and bile acids.[5-8] The objectives were to study the incidence of hyperlipidaemia in mothers of IUGR newborns and the impact of cord blood lipid profiles in IUGR newborns.

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MATERIALS AND METHODS

This is a prospective study done in the obstetrics and Gynaecology department at Chengalpattu Hospital. We included 50 pregnant women IUGR who met the inclusion and exclusion criteria. After obtaining informed consent from patients, 4ml of blood was withdrawn from the patient in a fast at 34 to 40 weeks. The lipid profile was assessed by the enzymatic endpoint or cholesterol oxidase method. The method's advantages are that a smaller sample quantity is needed, precise, specific, accurate, and more convenient than the conventional lipid assay.

Inclusion Criteria

Antenatal mothers with gestational age 34 to 40 weeks, gestational age between 34 to 40 weeks of newborns, and absence of any congenital anomalies were included.

Exclusion Criteria

Multiple gestations, preterm labour, premature rupture of membranes, chromosomal abnormalities, congenital malformations in newborns, and neonates with perinatal problems like hypoglycemia, pathological jaundice, neonates with HIE, and respiratory distress were excluded.

The cord blood of 4ml was collected after delivery, and assessed the lipid profile. Lipid profile includes total cholesterol, high-density lipoprotein, low-density lipoprotein, and triglycerides. Mothers were diagnosed and confirmed with IUGR by USG fetal Doppler and clinical findings.

Maternal and perinatal outcomes are analysed, such as Preterm labour, comorbidities, parity, birth weight, mode of delivery, ponderal index, liquor status, total cholesterol, HDL, LDL, triglycerides, and gestational age. All the demographic data were recorded, calculated, and presented in frequency and percentage.

RESULTS

We have included 50 IUGR antenatal mothers, of which 15 patients were under the age of 20 years, 16 patients under the age of 21-25 years, 15 patients under the age of 26-30 years, and four patients of more than 30 years. Twenty-three patients were primi, and 27 patients were multi. Twenty-eight antenatal mothers have risk factors which are nearly 56%. Thirty-five patients were delivered before 37 weeks, and 15 were delivered after 37 weeks of gestation. Twenty-eight patients were delivered by Cesarean section, and 22 had a normal vaginal delivery [Table 1].

Further, 4 (8%) patients delivered with babies (>1.5kgs), 20 patients (40%) delivered with babies (1.6 to 2.0kgs), and 26 patients (52%) delivered with babies (<2.5kgs). Thirty-eight have asymmetrical IUGR, and 12 have symmetrical IUGR. Among comorbidities, 15 were GHT, 9 were anaemia, and 5 were GDM. Three were hypothyroid, and 4 were preeclampsia. Twenty-eight patients had normal liquor, and 22 had oligohydramnios [Table 1].

Table 1: Demographic data of the study.

		Frequency	Percentage
Age	<20 years	15	30%
	21-25 years	16	32%
	26-30 years	15	30%
	>30 years	4	8%
Parity	Multi	27	54%
	Primi	23	46%
Risk factors	Yes	28	56%
	No	22	44%
Gestational age	Preterm	35	70%
	Term	15	30%
Mode of delivery	LSCS	28	56%
	LN	22	44%
Birth weight	>= 1.5 kgs	4	8%
	1.6 to 2.0 kgs	20	40%
	< 2.1 kgs	26	52%
Ponderal index	Asymmetrical IUGR	38	76%
	Symmetrical IUGR	12	24%
Comorbidities	Anaemia	9	18%
	GDM	5	10%
	GHT	15	30%
	Hypothyroid	3	6%
	Nil	14	28%
	Preeclampsia	4	8%
Amniotic Fluid Index	Normal	28	56%
	Decreased	22	44%

Table 2: Distribution of normal and increased biochemical parameters.

		Normal	Normal (%)	Increased	Increased (%)
Total Cholesterol	Maternal	42	84%	8	16%
	Cord blood	43	86%	7	14%
LDL	Maternal	46	92%	4	8%
	Cord blood	50	100%	0	0

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Triglycerides	Maternal	42	84%	8	16%
	Cord blood	40	80%	10	20%
HDL	Maternal	4	8%	46	92%
	Cord blood	9	18%	41	82%

We have seen that, out of 50 IUGR antenatal mothers, eight have increased total cholesterol levels, among which 7 of the IUGR newborns have increased cholesterol values. Four mothers have increased LDL levels which is nearly 8%. Eight have increased triglyceride levels by almost 16%, and 10 IUGR newborns have increased triglyceride levels by almost 20%. HDL decreased in 4 mothers, 8%, and nine newborns, nearly 18% [Table 2].

DISCUSSION

Our results support the hypothesis of a disturbed cholesterol supply in IUGR fetuses. Born IUGR has shown risk factors for developing cardiovascular disease later in life. As HDL has anti-inflammatory properties, it reduces HDL in intrauterine life and causes an increase in atherogenic indices. Out of 50 IUGR newborns, nine have decreased HDL levels, accounting for 18%, of which eight mothers have decreased HDL. There were no major correlations between maternal and fetal lipid levels or fetal birth weight and either maternal or fetal lipids in the IUGR mothers and newborns. Although fetal lipids do not directly correlate with maternal lipids in IUGR, these pregnancy complications significantly impact fetal lipid levels, possibly due to increased fetal stress or compromised placental lipid transport. Our findings are potentially pertinent to understanding the future cardiovascular health of the offspring. Our results reflect the possible interaction of environmental factors and fetal growth and in-utero lipid metabolism.

Small-for-gestational-age has been extensively studied as an adverse pregnancy outcome in Western countries. However, similar studies have rarely been conducted in Asian countries. While many risk factors for preeclampsia, such as increased body mass index, advanced maternal age, chronic hypertension, and diabetes, are now established in clinical practice, maternal lipid profile has not been included in the risk assessment for preeclampsia.[9,10] We aimed to characterize the serum levels of Total Cholesterol (TC), High-density lipoprotein (HDL), Low-density lipoprotein (LDL), and Triglycerides (TG) in the maternal and fetal circulations of normal pregnancy, fetal growth restriction (FGR).

TG levels were elevated in maternal cord blood Fetal Growth Restricted groups compared to normal pregnancies. Apolipoprotein levels A1 and B were not different between maternal groups. TC, HDL, LDL, and TC/HDL levels did not show significant gestational variation in maternal or fetal circulation between clinical groups.

Hyperlipidemia usually occurs in the pregnant woman. Because hyperlipidemia atherosis was seen in the uteroplacental spiral arteries, this decreased blood supply to the foetus, resulting in preeclampsia, IUGR. In hyperlipidemia, especially high BMI patients, the level of insulin resistance will be higher, and they have gestational diabetes mellitus. Patients with dyslipidemia are prone to preterm delivery and perinatal complications such as small for gestational babies, Large for gestational age, and stillborn.[5-7,9,11]

Many studies state that the abnormal lipid profile, and significantly elevated triglycerides, will result in preterm delivery and an increased risk of developing fetal compromise. The atherosis, which will develop in patients with abnormal lipid values with superadded hypercoagulable state of pregnancy, the chance of developing thrombosis, placental infarction, and uteroplacental insufficiency will affect the fetus resulting in preterm delivery and small for gestational age babies.[5,9,11]

Many studies show that elevated triglyceride will result in GHT, Preeclampsia, preterm delivery, and perinatal complications such as small for gestational age, large for gestational age, and child loss. The increased levels of preeclampsia are due to elevated plasma lipid levels, especially triglyceride levels, and its remnants will cause endothelial damage. Increasing lipid levels increase lipid peroxidation, thereby increasing oxidative stress, which is the main cause of preeclampsia and IUGR. They concluded that the triglyceride value is elevated throughout the pregnancy in pregnant women with IUGR, and HDL cholesterol values were also low. So, they observed that dyslipidemia might be important in the pathogenesis of IUGR.[11-14]

TG levels significantly decrease in preterm birth. No association between preeclampsia and gestational diabetes mellitus with lipid profile changes was noted except in patients with glucose intolerance (>140 mg/dl in 50 g screening test) in which change in cholesterol, LDL was low, and TG was high. Total cholesterol concentration was significantly decreased in the IUGR. HDL concentrations were decreased in the IUGR, and TG concentration was significantly increased in IUGR.

Many studies stated that elevated triglycerides were important in preeclampsia and GDM.[9,11,15] In our research, a few patients developed preeclampsia; we concluded that the high triglyceride level might predispose them to preterm delivery, which is statistically significant. All the outcomes were analyzed with Serum LDL levels and found statistically insignificant results. The HDL values and pregnancy outcomes were examined and found to have statistically insignificant results.

Ghodke et al. stated that the values of Total Cholesterol, HDL, LDL, and VLDL could not predict the occurrence of preeclampsia, GDM, and

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preterm deliveries—intrauterine growth mentally disabled newborns with altered lipid profiles in Indian IUGR neonates. Further research is essential in determining fetal growth and creating ways to prevent fetal malnutrition and future complications.[16]

The limitation of our study is the lipid profile should be assessed in each trimester as it helps in knowing about the increasing levels of lipids in each trimester and preventing early and late complications by giving diet control and lifestyle modification. This study was done only in the 3rd trimester, so the outcome due to lipid abnormalities cannot be appropriately analysed. Many populations must observe the difference in lipid profile and know its outcome.

CONCLUSION

It is clearly understood that IUGR mothers have altered lipid profiles, indirectly affecting the foetus's lipid metabolism. It is understood that there is some increase in the foetus's triglycerides and a decrease in HDL. This leads to low-birth-weight babies, poor milestones after birth, malnutrition, and early onset of atherosclerotic plaques in the growing child, leading to early coronary artery disease and other vascular complications.

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