Original Research Article

Comparative study of cord blood lipid profile in preterm and post term neonates

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ABSTRACT

Background: The fetal-origin hypothesis and fetal programming emphasize the profound and sustained impact of factors related to fetal health on the development of chronic disease in adulthood. Several studies suggested that low birth weight and preterm birth linked to abnormalities in cord lipid profile and higher prevalence of atherosclerotic cardiovascular disease. Authors objectives was to estimate and compare cord lipid profile in term, pre-term, and post-term neonates.

Methods: In the study group, there were 200 healthy Polish newborns. Newborn characteristics included sex, gestational age at birth, Apgar score, and anthropometric data (weight and length at birth, neonatal ponderal index, head, chest and abdominal circumferences, placental weight, and placental-fetal weight ratio). Cord blood samples were collected for total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL), and triglycerides (TG). Information regarding selected maternal factors was collected. Neonates were classified into preterm (<37 weeks) and term (≥37 weeks) based on new Ballard scoring.

Results: The preterm had higher Total cholesterol compared to Term and post term and it was Statistically Significant with a p value of < 0.001. The preterm had higher Triglycerides compared to term and post term and it was statistically significant with a p value of <0.01. The preterm had higher HDL compared to Term and post term and it was statistically significant with a p value of <0.001. The preterm had higher LDL compared to Term and post term it was statistically significant with a p value of <0.001. The preterm had higher VLDL compared to Term and post term and it was statistically significant with a p value of <0.01.

Conclusions: Abnormal intrauterine milieu created by maternal changes during gestation may bear a profound impact on lipid metabolism in neonates, which may account for their differences in lipid profile and anthropometry at birth.

Keywords: Birthweight, Cord blood, Gestational age, Lipid profile

INTRODUCTION

Human fetuses are known to permanently change their physiology and metabolism to adapt to the limited supply of nutrients in utero. These programmed changes can later be the cause of the origin of diseases like coronary artery disease, diabetes mellitus, and hypertension.[1] The cord blood lipid profile may be associated with lifelong changes in the metabolic functions of the individual.[2] It is well documented that atherosclerosis starts in childhood and there is evidence that this association with adult levels may originate at birth, so assessment of serum lipid levels in neonates might be of importance.[3] The triglycerides have an active role in surfactant synthesis and are needed for lung maturity in term neonates, but there are very few reports regarding their serum distribution pattern The relationship between low birth weight and adult cardiovascular disease has been

attributed to intrauterine effects on fetal tissue development. Coronary heart disease (CHD), hypertension, and diabetes mellitus (DM) occur in epidemic proportions worldwide.[4] Unhealthy lifestyle practices and behaviors are well accepted as contributing factors, but the true origins of these diseases may actually be found in utero. Primarily cord blood screening has been utilized to detect the population at greater risk of developing atherosclerosis, a pathological hallmark of coronary heart disease. Its utility is further recognized for lipid fractional analysis, which also has been employed for screening and diagnostic evaluation of various other disorders.[5] A fetus is a complete parasite depending on its mother for energy, oxygen, and other metabolic requirements. All exchanges of these essential elements take place through the placenta. Normally during intra-uterine life glucose is the primary source of energy for the fetus.[6] Free fatty acids are the alternative source of energy. Immediately after birth, with cessation of maternal blood supply, free fatty acids become an important source of energy during the first few hours of life.[7] At birth normally the cord blood level of free fatty acids and triglycerides are low. Free fatty acids and triglycerides levels rise rapidly in the immediate postnatal period. An elevation of two and ten folds respectively in their levels by about 6 to 12 hours of age has been documented.[8] This rise in free fatty acids and triglycerides levels is probably due to the mobilization of free fatty acids from mobile fat stores and subsequent increase in the hepatic glyceride synthesis followed by its release in blood. This physiological response if exaggerated by various adverse conditions and unfavorable environment causes interferences with the fetal oxygenation and results in antepartum and /or intrapartum hypoxia.[9]

METHODS

This was a prospective observational study carried in for 2 years from 2017 July 2018 March. Totally 200 babies included in which 114 are preterm babies, 80 are post-term babies.

Inclusion criteria

All neonates who are delivered in Sree Balaji medical college and hospital.

Exclusion criteria

- Neonates with any Congenital malformations.
- Neonates born to mother with a maternal illness like Diabetes mellitus (DM) including Insulin-dependent diabetes mellitus (IDDM) and gestational diabetes, Tuberculosis, Asthma, Pregnancy-induced hypertension, thyroid disease.
- Neonates with a family history of coronary heart disease / hypercholesterolemia.
- Any maternal medication, except iron and vitamin supplements.
- Drug abuse in mother and antenatal medications.
- Instrumental delivery including extraction.
- Neonates with one minute Apgar score <7.

Procedure

All the subjects were included after obtaining written informed consent from parents/ guardian, 5 ml of cord blood was collected from the umbilical cord immediately after the delivery from the placental end of the cord just after the delivery of the baby in a plain dry test tube. Cord blood was allowed to clot and then immediately sent to the lab where the samples were centrifuged at 400× for 10 minutes, and then serum was separated and stored at -20ºC until analysis. After the delivery, the babies were examined, weight was recorded on the electronic weighing scale, length was recorded with the help of infantometer, head circumference, chest circumference, and other relevant anthropometric data were recorded using a non-stretchable measuring tape. Gestational age was calculated from the first day of the last menstrual period and confirmed by clinical assessment using the modified New Ballard's score. A thorough clinical examination of the newborn was done and the weight of the baby was calculated by an electronic weighing scale. Classification of infants was done based on gestational age at the term and preterm newborn based on New Ballard's scoring. Babies were classified as AGA and SGA with the help of intrauterine growth charts and Ponderal index. Intrauterine growth charts developed at AIIMS were used to assess the weight for gestational age. Any baby whose weight was less than the 10th percentile for the respective age was classified as SGA and neonates who were between 10th and 90th percentiles were classified as AGA. Ponderal index was computed as, PI = Weight (GM)/Length (CM) 3 x 100. Ponderal index of <2.0 between 29 and 37 weeks of gestation and <2.2 beyond 37 weeks of gestation was taken as a cut off value to classify SGA babies. Lipid profile was done by using Autoanalyzer (Erba Mannheim, Transasia bio-medical LTD). TC estimated by using Modified Roe Schlau method, TG estimated by using Wako and the modification by McGowan et al.

Statistical analysis

The package EPI-INFO version 3.5.3 was used for the analysis of the data and Microsoft Excel was used for data entry as well as to generate graphs, tables etc. Results were expressed as the mean±standard deviation for continuous variables and as number and proportion (%) for categorical data. Since all data are known to be normally distributed, the parametric tests were used for statistical analyses. Preterm, and post term neonates as well as between male and female neonates were determined by Student's t-test. Chi-square test was applied to test the association between two categorical factors. All the tests of significance were applied at 5% level of significance.

RESULTS

In Table 1, the present study the total number of cases was 200 out of which, term 114 were the preterm were 80 and post-term were six. There was no statistically significant difference between them according to gestational age.

In Table 2, the preterm had higher total cholesterol compared to term and post term and it was Statistically Significant with a p value of < 0.001. The preterm had higher Triglycerides compared to term and post term and it was statistically significant with a p value of <0.01. The preterm had higher HDL compared to term and post term and it was Statistically Significant with a p value of

<0.001. The preterm had higher LDL compared to Term and post term it was statistically significant with a p value of <0.001. The preterm had higher VLDL compared to Term and post term and it was statistically significant with a p value of <0.01.

Table 1: Gestational age distribution.

GA	No	%
Term	114	57.0%
Pre Term	80	40.0%
Post term	6	3%
Total	200	100.0%

Table 2: Comparison of mean values and standard deviation of cord lipid profile among term and preterm neonates.

Lipid profile	TC Mean±(SD)	TG Mean±(SD)	HDL Mean±(SD)	LDL Mean±(SD)	VLDL Mean±(SD)
Term (n=114)	82.63±27.16	71.21±22.35	28.36±06.29	39.85±14.10	14.43±04.47
Preterm(n=80)	98.91±26.60	80.75±12.84	34.56±05.35	53.77±25.25	16.15±04.30
Post term (6)	79.82±21.89	69.83±14.5	25.85±7.8	38.09±8.3	13.89±3.4
p value	<0.001	<0.01	<0.001	<0.001	<0.001

DISCUSSION

A lipid profile is a marker of an underlying cardiovascular status, and there is a direct correlation between the abnormalities in lipid profile and occurrence of cardiovascular morbidities and mortality.[10] Levels of Lipids and Lipoproteins in the cord sera should be a reflection of the status of plasma lipid metabolism in the infant at birth because most fetal Lipids are synthesized de novo through the conversion of glucose to various fatty acid containing compounds.[11] The only part of it is derived from placental circulation, so measurement of cord blood Lipid profile will be like measuring Lipid metabolism during fetal life and at birth. Among various factors theorized in the development of atherosclerosis, increased plasma levels of cholesterol and/or triglycerides are considered to be most important.[12] Furthermore, a number of investigators now consider only LDL and HDL as major risk factors on the development and progression of atherosclerotic vascular diseases. Hence determinations of cord lipid profile become a useful tool in the earlier detection of babies at a higher risk since several investigators believe that the atherosclerotic lesions may have its genesis in childhood.[13] The cord blood lipid profile screening of neonates in this part of southern India was almost comparable with babies screened in other parts of the world Comparison of anthropometric data of the present study with earlier revealed that the BW, Length, HC were in agreement, however, the AC varied from the reports.[14] Recent reports

indicate that neonates with a negative correlation of BW and AC have higher glycated serum proteins. The disproportional intrauterine growth observed in these neonates are said to be in line with the concept of so-called brain sparing, a mechanism maintaining the intrauterine growth of the brain at the expense of trunk growth. This retarded trunk and visceral growth could have resulted from cranial redistribution of oxygenated blood away from the trunk to sustain brain metabolism. The HDL, LDL, and TC levels were higher in LGA babies in the order LGA > AGA > SGA, however, these changes were found to be statistically insignificant.[15] Dogra J, et al, in their study concluded that Preterm neonates have higher TG and TC levels but a statistically significant difference was found only in TC (p<0.001) levels.[16] Kumar A, Gupta A et al, in their study concluded that TC, LDL, HDL were higher in Preterm neonates compared to term neonates with the statistically significant difference in TC and LDL (p<0.001) levels, but HDL had no statistically significant difference. AI values were more in preterm compared to a term which was not statistically significant.[17] Van-der-schouw YT et al, in their study concluded that all Cord lipid profile values were lower in preterm neonates compared to term neonates but statistically, a significant difference was found with TC levels (p <0.001) and no statistically significant difference was found with HDL and LDL levels.[18] Kherkeulidze P et al, in their study concluded that TG levels were more in term compared to term with no statistically significant difference. In our study higher cord lipid levels in preterm babies could be explained by

the fact that preterm babies lack both hepatic carbohydrate and subcutaneous adipose stores, with a result that circulating fuel is low and may run out.[19] The rise in cord blood cholesterol levels may reflect the metabolic adaptation to provide adequate energy, especially to organs like the brain.[20]

CONCLUSION

To conclude, fetal cardiovascular adaptations appear to have a long-term influence on health in postnatal life. The placenta may be of importance in determining these changes. Our study described differences between the genders in cord blood lipid profiles. The influence of gestational age and the mothers' preconception BMI on lipid concentrations were also observed. Further investigations are needed, focusing not only on short-term outcomes, such as the influence of various harmful factors on the anthropometry of the offspring but also on some biochemical markers in umbilical cord blood that may be used in the diagnosis of metabolic disorders. It is possible that in the future, by detecting such factors and markers, the identification of newborns with a higher risk of developing cardiovascular diseases will be possible.

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