Umbilical Cord Blood Lipid Parameters and its Correlation with Birth Weight of Neonates

Suman Jain[1], Sharda Goyal[2], Harshdeep Jadeja[3], U. D. Deshmukh[4]

[1]Assistant Professor, Department of Biochemistry, Pacific Institute of Medical Sciences, Udaipur, India

[2]Department of Obstetrics and Gynecology, Geetanjali Medical College and Hospital, Udaipur, India

[3]Department of Obstetrics and Gynecology, Geetanjali Medical College and Hospital, Udaipur, India

[4]Department of Biochemistry, American International Institute of Medical Sciences, Udaipur, India

Abstract: _Introduction: Cardiovascular diseases are the leading cause of mortality in India. The important factor associated is dyslipidemia. A strong relationship has been seen in epidemiological studies between cholesterol and cardiovascular disease. The present study was planned to analyse cord blood lipid profile, apolipoproteins and atherogenic index and to see their relationship with birth weight. Method: Our study group consisted of 300 healthy fulterm newborn. The cord blood was collected immediately after a normal delivery. The blood was tested to determine lipid parameters and was correlated with birth weight. Result: The results showed that the levels of (TC), triglyceride, (HDL) and atherogenic index was higher whereas LDL was lower in high birth weight babies as compared to low birth weight and normal birth weight newborns. The correlation was positive with TC, LDL-Cholesterol, ApoB and atherogenic index but negative with TG, HDL-C and ApoA-1._

Keywords: Lipid profile, Apolipoproteins, Atherogenic index, Cord blood.

1. Introduction

Atherosclerosis is the major cause of global mortality and will continue to dominate trend in future. (1) Atherosclerosis is a process that begins in early in life and progresses silently for decades, some of scientist believe that atherosclerotic lesions may have its genesis during childhood. (2, 3) increased risk of CVD is associated with lifestyle and various medical conditions, such as hypercholesterolemia, hypertension, smoking, obesity and inadequate physical activity. (4)

A foetus needs a considerable amount of cholesterol for development of tissues and organs. After birth lipid transport system is transformed from one containing low VLDL and LDL levels to adult system with a relatively high LDL levels which continues to increase with age. Cord blood contains all adult lipoproteins and apolipoproteins. (5) Abnormal lipid profiles in childhood persist into adult life and elevated ApoB in adult have been linked to atherosclerosis in later life. (6) On the basis of research conducted have shown that the high prevalence of atherosclerosis risk factor and increased morbidity and mortality due to cardiological diseases within the urban areas is more than rural areas. (7, 8) Moreover, several maternal and fetal factors, such as hypertension, diabetes, obesity and low or high birth birth weight can influence fetal plasma lipids. (9)

Disorders of lipid metabolism and elevated levels of low density lipoprotein (LDL-C), total cholesterol (TC) and apolipoproteinB (ApoB) levels in young adults have been connected with cardiovascular diseases in the life. (7) Dirisamer et al (2006) have showed evidence that levels of ApoB, ApoB/apoA-1 ratio as well as LDL-C concentrations are sensitive indicators for later coronary heart disease in children. (8) ApoB/ ApoA-1 ratio known as atherogenic index is sensitive marker to track coronary artery disease is found to be measured closely during first year of life. (10) Screening patients for ApoA-1 and ApoB levels may significantly improve ability to properly evaluate CAD risk. (11) with Low birth weight is associated the increased incidence of CVD, hypertension and type II diabetes (12) Changes in blood lipids in low birth weight newborns with relative insulin intolerance can increase the risk of CVD in adulthood. LBW is a risk of later atherosclerotic diseases that is equal to smoking or hypertension at puberty. (13) Therefore it seems that there is some relation between birth weight and mortality from CVD in adulthood. Hence present study was planned to check the correlation of lipid parameters and birth weight of newborns.

2. Material and Methods

The present prospective study was conducted n the department of Biochemistry, Geetanjali Medical College and hospital, Udaipur. A total of 300 healthy neonates (following healthy normotensive pregnancy) were included in the study and were divided on the basis of birth weight.

Inclusion criteria for mothers:
Healthy mother only on iron folic acid and calcium supplementation.

Exclusion criteria for mothers:
History with alcoholism, smoking hypertension, thyroid disorders, diabetes mellitus, renal diseases, hypercholesterolemia, twins, liver diseases, tuberculosis and asthma, pregnancy induced hypertension.

Inclusion criteria for neonates:
Gestational age between 35-42 weeks and Absence of congenital anomalies.

Exclusion criteria for neonates

Congenital malformations, Neonates born to mother with maternal illness, Neonates with perinatal problems like hypoglycemia, pathological jaundice, Intrumentaldelivery including extraction and also Neonates with hypoxic ischemic encephalopathy and sepsis.

Sample collection

After delivery and cord clamping umbilical venous blood was taken from maternal umbilical end. Serum was separated and analyzed for lipid profile (total cholesterol, Triglyceride, HDL-C, LDL-C, and VLDL-C) and Apolipoproteins (ApoB, ApoA-1).

Estimations

The levels of Triglyceride, total cholesterol and HDL –C were assayed with reagent by Roche. The concentrations of LDL-C and VLDL –C was defined by using the formula given by Friedewald.(14) Apolipoproteins were assayed by immunoturbidimetric method. (15) The assay were performed with cobas c311 fully auto analyzer instrument.

Statistical Analysis

The mean and standard deviation has been used to define data in each group. The data were correlated with birth weight using Pearson correlation.

3. Observation and Results

Table 1: Mean ± SD level of Lipid profile in cord blood in different newborn having different weight.

S.N.	Parameters	Low birth weight <2.5kg (N=33)	Normal birth weight 2.5-4.0kg (N=171)	High Birth weight >4.0 kg (N=96)
1	Total Cholesterol mg/dL	67.90±17.13	68.78±16.92	70.71±16.83
2	Triglyceride mg/dL	47.72±21.10	52.90±23.50	54.27±24.91
3	HDL-C mg/dL	27.15±9.79	29.52±10.62	30.10±10.98
4	LDL-C mg/dL	31.21±14.15	28.67±14.97	29.75±16.27
5	VLDL-C mg/dL	9.54±4.22	10.58±4.70	10.85±4.98
6	ApolipoproteinB mg/dL	31.70±7.30	31.16±7.50	31.40±5.26
7	ApolipoproteinA-1 mg/dL	52.34±9.01	52.92±9.43	52.30±8.79
8	AI ApoB/ ApoA-1	0.63±0.22	0.62±0.23	0.60±0.11

Table 2: Correlation of birth weight with lipid parameters

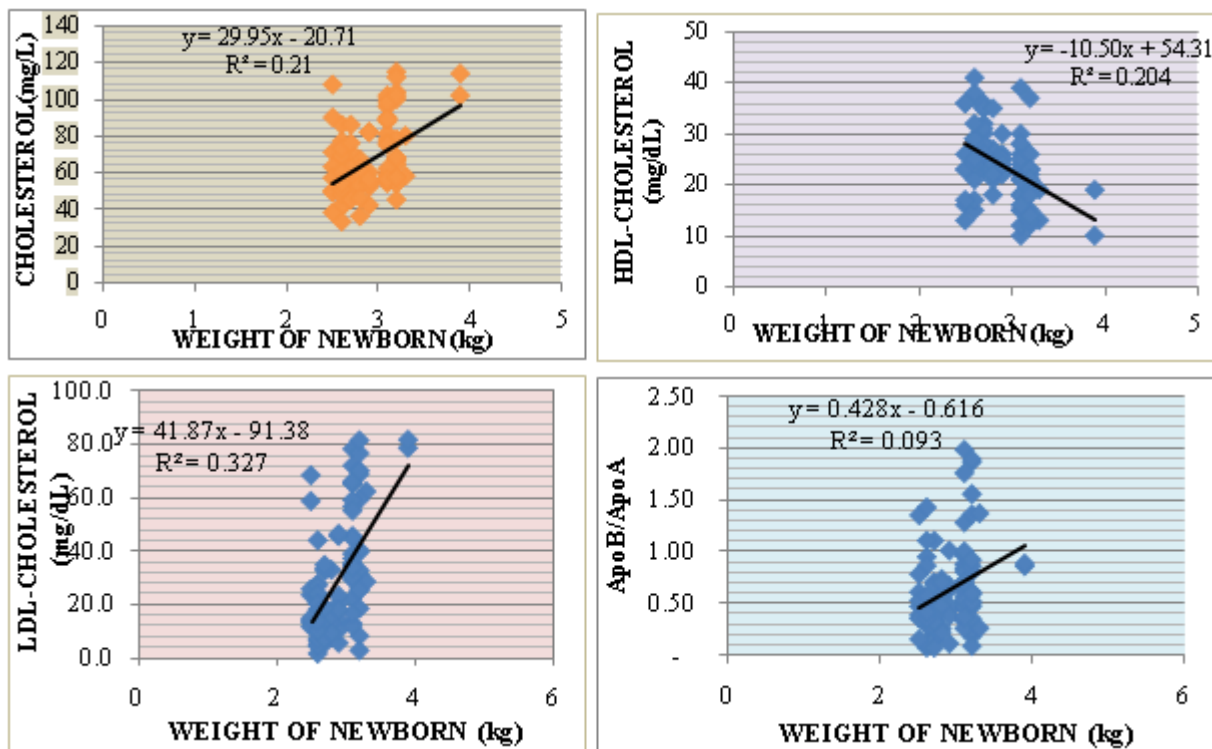| S.No.	PARAMETERS	Mean ± SD	r-value	p-value
1	Total Cholesterol mg/dL	70.47± 16.79	0.430	0.0004
2	Triglyceride mg/dL	54.80 ± 23.90	-0.083	0.205
3	HDL-C mg/dL	31.16 ± 10.59	-0.111	0.134
4	LDL-C mg/dL	27.27 ± 15.20	0.259	0.004
5	VLDL-C mg/dL	10.15 ± 0.78	0.598	0.000
6	ApolipoproteinB mg/dL	30.68 ± 6.97	0.273	0.0005
7	ApolipoproteinA-1 mg/dL	54.36 ± 8.89	-0.187	0.060
8	AI ApoB/ ApoA-1	0.61 ± 0.19	0.304	0.000

Figure 1: Correlation scatter plots with different parameters

4. Results

A total of 300 newborns, 33 (11%) were low birth weight, 171 (57%) were normal birth weight and 96(32%) were high birth weight neonates were studied. The mean total serum lipid levels in these newborns were compared and mean and standard deviation were calculated. Table 1 shows mean and SD values in different groups. The results showed that the levels of total cholesterol (TC), triglyceride (TG), high

density lipoprotein (HDL) and atherogenic index were higher whereas low density lipoproteins was lower in high birth weight babies as compared to low birth weight and normal birth weight newborns. The differences were statistically non significant.

Table2 and Figure1showed correlation among the measured parameters and weight of the newborn. The correlation of lipid profile, apolipoproteins and atherogenic index with birth weight were showed. The positive correlation was found with total cholesterol, LDL-Cholesterol, Apo B and atherogenic index but TG, HDL-C and ApoA-1 were negatively correlated. Total cholesterol was positively correlated with high significance. Triglyceride and HDL-cholesterol were negatively correlated without significance. LDL- cholesterol showed positive correlation with high significance.

The Apolipoproteins were also estimated and correlated with neonatal weight. Apolipoprotein A -1 showed negative correlation like HDL- cholesterol and was not significant. Apolipoprotein B was positive correlated with significance. The ratio or atherogenic index was positive correlated with significance and same was the correlation with LDL-C/ HDL-C.

5. Discussion

The cord blood lipid parameters screening of neonates in this part of southern Rajasthan were almost comparable with other reports. Atherosclerosis originates during childhood and the serum lipid levels are a key factor in the process. The observation in cord blood reveals to study the risk factor variable in the early stage. The observations in infancy provide a background for the studies in older children and adults. According to newborn weight the subjects were divided into three groups, group I were low birth weight neonates with weight less than 2.5kg, Group II normal birth weight neonates having weight 2.5kg to 4kg and group III as high birth weight neonates with more than 4kg.

The mean cholesterol levels were 70.47± 16.79 mg/dl which is less than the reports of Puspedra et al, 2013 and other where the values were 83.30± 28.10, 76± 19, 94± 32, 79± 17 and even 105.6± 17.1. The values were higher ranging from 64± 19 has been noted in other studies. (16, 17, 18) The mean triglyceride levels noted in present study were much lower than the adult values. Perhaps the quiescent state of fat utilization in the fetus and the absence of need for fat mobilization is responsible for low serum triglyceride at birth. The values of HDL-C and LDL-C were similar to those reported in other studies. (19)

Fetal growth retardation establishes a lifelong irreversible atherogenic profile and men with low birth weight have been reported to have an atherogenic profile. In the present study apolipoproteinA-1 and apolipoproteinB were estimated and correlated with birth weight. The results showed that the ApoB is most strongly associated with ischemic heart diseases risk. A decrease in ApoB of 10% was associated with 22% reduction in risk of ischemic heart disease. (20) In our study the Apo B levels in the cord blood were found to

be 30.68± 6.97 which was similar to the values of 28.10± 16.90 reported by a past study. (21)

Birth weight is a measure of fetal growth which summates body size, body length and subcutaneous fat. Studies have shown that babies who have a reduced birth weight in relation to gestation tend as adults to develop syndrome "X"a combination of hyptension, non- insulin dependent diabetes mellitus, disordered lipids, hyperinsulinemia, obesity and abdominal fatness.(22) The present study demonstrated that cord blood cholesterol level do not have significant association with the birth weight as has been reported by kumar et al.(23) Birth weight below and above 2.5kg did not find any significant association with any of the other lipid parameters except LDL and Apolipoprotein B. In studies by Desai also showed no association (24) but in study by Mathur a significantly lower cholesterol was found among babies weighing lower than 2.5 kg. Though atherogenesis is a pediatric process has been known for decades, the reversibility of the injuries in this early phase of life is open to speculate. (25)

6. Conclusion

The findings of the study again reaffirm the link between prenatal factors and cord blood lipid parameters.

7. Acknowledgement

References

[1] Barker DJP, Fetal and infant origins of adult disease. monalsschr, kinderheilkd 2001(suppl): 149-52-56.
[2] Mc Gill HJr, Mc Mahan CA. Determinants of atherosclerosis in the young, pathobiological determinats of Atherosclerosis in youth (PDAY) Research Group. AM J Cardiol. 1998 Nov 26; 82 (10B) : 30T-36T.
[3] MC Millan GC. Development of atherosclerosis. Am J cardiol. 1973; 31 : 542-6.
[4] Santos MG, Pegoraro M, Sandrini F, Macuco EC. Risk factors for the development of atherosclerosis in childhooh and adolescence. Arq Bras Cardiol. 2008; 90: 276-283.
[5] Mc conathy WJ, Lane DM. Studies on the apolipo proteins and lipoproteins of cord serum pediatr. Res 1980; 14: 757-61.
[6] Klag MJ, Ford DE, Mead LA, et al. Serum cholesterol in young men and subsequent cardio vascular disease. N Engel J med 1993; 328 : 313-8.
[7] Abdul –Rahim HF, Hussein A, Bjertness E, Giecaman R, Gordon NH, Jervell J. The metabolic syndrome in the west bank population. An urban – rural Comparison. Diabetic care 2001; 24: 275-279.

[8] Dirisamer A, stadler A, Bucek RA, Widhalm K. Apo B – 100 and Apo-B/Apo-A-1 ratio in children and adolescents from families with very early myocardial infarction. Acta paediatr 2006; 95: 810-3.

[9] Dolphin PJ. Breckenridge WC, Dolphin MA, Tan MH. The lipoproteins of human Umbilical cord blood, apolipoproteins and lipid levels. Atherosclerosis 1985; 51: 109-122.monalsschr, kinderheillkd, 2001 (suppl): 149-52-56.

[10] Yavuz T, Yavuz O, Ozdemir I, Afsar Y. Cord blood lipoprotein profile after magnesium sulphate treatment in Pre – eclamptic patients. Acta paediatr 2006; 95: 1224-7.

[11] Sattar N, Williams K, Siriderman AD, Agostino RB, Haffner SM. Comparison of the associations of apolipoprotein B and high density lipoprotein cholesterol with other cardiovascular risk factors in patients with the metabolic syndrome in the insulin resistance Atherosclerosis study. Circulation 2004; 110: 2687-93.

[12] Baker DJ, Hales CN, FallCH, Osmond C, Phipps K, Clark PM. Type 2 (non-insulin dependent) diabetes mellitus, hypertension and hyperlipidemia (syndrome): relation to reduced fetal growth. Diabetolgia. 1993; 36: 62-67.

[13] MJ Law C, Zhang KL, Osmond C, Stein C, Barker D. Effects of infants birth weight and maternal body mass index in pregnancy on components of the insulin resistance syndrome in China. Ann Intern Med 2000; 132: 253-260.

[14] Friedelwald WT, Levy RI, Fredrickson DS. Estimation of concentration of low density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clin Chem. 1972; 18: 499-502.

[15] Dati F. Estimation of apolipoproteins by immunoturbidimetric method. Lab Med 1989; 13: 87-89.

[16] Pushpendra magon, RS bharatwaj, Manorama Verma, Jugesh Chatwal. Cord blood lipid profile at birth among normal Indian newborns and its relation to gestational maturity and birth weight- A cross sectional study. Indian journal of research. July2013; 2(7): 215-218.

[17] Barnes K, Westael PJ, Payne E.S. Neonatal plasma lipids. Medical Journal of Australia. 1972; 28: 1002.

[18] Dubowitz LMS, Dubovitz v, Goldberg C. Clinical assasment of gestational age in the newborn infant. Journal of pediatrics 1970; 77(1): 1-10.

[19] Jungner I, Sniderman AD, Furberg C, Aastvert AH, Holme I, Walldius G. Does low- density lipoprotein size add to atherogenic particle number in predicting the risk of fetal myocardial infarction? Am J Cardiol 2006; 97: 943-946.

[20] Potter JM, Perinatal plasma lipid concentration Aust NZJ. 1977; 155-160.

[21] Wald NJ, Law M, Watt HC, Wu T et al. Apolipoprotein and ischemic heart disease, implications for screening. The lancet. 1994; 343: 75-79.

[22] Dolphin PJ. Breckenridge WC, Dolphin MA, Tan MH. The lipoproteins of human Umbilical cord blood, apolipoproteins and lipid levels. Atherosclerosis 1985; 51: 109-122.monalsschr, kinderheillkd, 2001 (suppl): 149-52-56.

[23] Kumar A, gupta A, Malhotra VK, Agarwal PS, ThirupurumS, Gind B. Cord blood lipids. Medical j of Australia 1972;28: 1002.

[24] Desai M, Patil K, Shah R Mudhokar R, Cord blood lipids and lipoproteins in normal neonates. Indian Pediatrics 1977; 14(5): 373-377.

[25] Mathur PP, Prasad R, Jain SK, Pandey DN, Singh SP. Cord blood cholesterol in term and preterm newborns.Indian pediatrics. 1986; 23: 103-105.