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Original Research Article

Comparison of lipoprotein and apolipoprotein levels in cord blood

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ABSTRACT

Background: Hyperlipidemia is the primary risk factor for coronary artery disease and subsequently leading to morbidity and mortality in adulthood. It is a well-known fact that coronary artery disease can initiate in the fetal stage itself. The present study was planned to analyse cord blood lipoproteins and apolipoproteins levels and its association with gender and birth weight.
Methods: This cross-sectional study was conducted in the Department of Biochemistry, in collaboration with Department of Gynecology and Obstetrics at SKIMS Medical College and Hospital, Bemina, Srinagar. A total 200 pregnant women who delivered by normal vaginal delivery and caesarean section were included in the study. 10 ml of umbilical cord blood was collected in a plain vial from the placental end within five minutes of delivery and serum lipoprotein and Apo-lipoprotein levels were measured.
Results: Out of 200 newborns102 were males and 98 were females. Statistically significant difference was seen in parameters Apo A1, Apo B, Atherogenic index (Apo B/Apo A1) and LDL between the genders rest of the parameters were statistically. Also 32 newborns (16.0%) had <2500, 152 (76.0%) new born had 2500-4000 and 16(8.0%) > 4000 grams birth weight. The mean lipoprotein and Apo-lipoprotein levels in these new born were compared between the groups. The mean serum levels of TC, TG, LDL and HDL were statistically significant (<0.05) between the three groups were as Apo A1, Apo B, Atherogenic index (Apo B/Apo A1) and VLDL was insignificant (>0.05) respectively.
Conclusions: CVD being a leading cause of morbidity and mortality in the developing countries, early screening of the at risk babies i.e. low birth weight newborns using cord blood lipoproteins and apolipoproteins levels helps in primordial and primary prevention of diseases.

Keywords: Apolipoprotein, Birth weight, Cord blood, Lipoprotein

INTRODUCTION

Hyperlipidemia is the primary risk factor for coronary artery disease and subsequently leading to morbidity and mortality in adulthood. The progression of coronary artery disease initiates early in life and progresses silently for years. It is a well-known fact that coronary artery disease can initiate in the fetal stage itself.[1] The 'fetal origins hypothesis' indicates that intense and continuous impact of factors related to the fetal health including coronary artery disease on the process of chronic diseases in adultlife.[2] Significant evidence have proven that children with hypercholesterolemia are at high risk of subsequent coronary artery disease.[3-6] Epidemiological studies have shown a strong independent association between serum cholesterol and coronary artery disease.[7] Maternal dyslipidemia has been related to increase early coronary artery disease and significant surge in fatty

streaks in human newborns.[8] There is a well-established fact that cord sera contains all characterized adult lipoproteins and apolipoproteins and chronic pattern of atherogenic lipoprotein metabolism is associated with fetal growth restrictions.[9] Elevated lipoprotein levels in childhood continue into adult life and raised Apo B levels in young adults have been associated to coronary artery disease in progressive years of life.[10] Early stage of life can be seen as an opportunity to initiate preventive interventions to change risk factors for cardiovascular diseases.

Recent studies showed that detection of these markers (lipoproteins and apolipoproteins levels) in the umbilical cord blood from the newborns could recognize neonates at a higher risk for coronary heart disease.[11] As such; limited studies exist on the difference of the cord blood concentrations according to the birth weight and gender of the newborns.

The present study was planned to analyse cord blood lipoproteins and apolipoproteins levels and its association with gender and birth weight.

METHODS

This cross-sectional study was conducted in the Department of Biochemistry, in collaboration with Department of Gynecology and Obstetrics at SKIMS Medical College and Hospital, Bemina, Srinagar.

Inclusion criteria

- A total 200 pregnant women who delivered by normal vaginal delivery and caesarean section and were on supplementation of vitamins, iron, folic acid and calcium with gestational age between 35-42 weeks were randomly included in the study after obtaining informed and written consent.

Exclusion criteria

- Pregnant women with history of maternal hypertension either before or during pregnancy, pre-eclampsia or eclampsia, history of paternal or maternal hyperlipidemia, maternal CVD, pre-gestational or gestational diabetes, any history of maternal drug use during or before pregnancy including women receiving glucocorticoid therapy for fetal lung maturation or a history of smoking were excluded.

Maternal and newborns details were noted in a predesigned proforma. 10ml of umbilical cord blood was collected in a plain vial from the placental end within five minutes of delivery and then the serum was separated by centrifugation. Serum lipoprotein and Apo-lipoprotein levels were measured using an enzymatic method in an auto analyser (Beckman Coulter AU 5800). Atherogenic index (AI) was calculated as ratio of Apo B to Apo A1. Birth weight was measured with an electronic scale. Newborns were divided into 3 groups according to their birth weight, less than 2500 grams as group I, 2500-4000 grams as group II and more than 4000 grams as group III.

Statistical analysis

Data was analysed with SPSS 20.0 for Windows (SPSS Inc., Chicago, IL, USA). Results were expressed as mean±SD.

The student's t-test, analysis of variance (ANOVA) and Chi square test was used to make statistical comparisons. A P-value <0.05 was considered statistically significant.

RESULTS

A total of 200 newborns [102 (51.0%) males and 98 (49.0%) females] were included in the study.

Table 1: Demographical profile of mothers.

Parameters		Male new born	Female new born	Chi-square	P-value
Life style	Active	72 (70.6%)	86 (87.8%)	8.878	<0.01
	Sedentary	30 (29.4%)	12 (12.2%)		
Socio-economic status	Lower class	30 (29.4%)	48 (49.0%)	8.044	<0.01
	Middle class	72 (70.6%)	50 (51.0%)		
Occupation	House wife	100 (98.0%)	98 (100%)	1.941	>0.05
	Working	02 (2.0%)	0 (0.0%)		
Order of the issue	1st	42 (41.2%)	52 (53.1%)	3.042	>0.05
	2nd	34 (33.3%)	24 (24.5%)		
	≥3rd	26 (25.5%)	22 (22.4%)		
Gestational age	Term	92 (90.2%)	96 (98.0%)	5.340	<0.05
	Pre-term	10 (9.8%)	02 (2.0%)		
Mode of delivery	C-section	24 (23.5%)	10 (10.2%)	6.289	<0.05
	Normal	78 (76.5%)	88 (89.8%)		

Table 2: Comparison of genders of newborns.

Parameters	Male (n=102)	Female (n=98)	Sig. (p-value)
Apo A1	48.31±21.79	67.27±19.73	0.0001
Apo B	29.07±10.00	19.62±6.81	0.0001
AI (ApoB/ApoA1)	0.60±0.45	0.29±0.34	0.0001
Total Cholesterol	62.47±17.08	59.80±17.03	0.435
TG	55.39±23.46	52.53±21.35	0.526
HDL	18.88±10.14	20.04±9.49	0.557
LDL	53.66±11.28	35.63±10.33	0.0001
VLDL	6.65±4.51	5.14±3.78	0.075

Table 3: Comparison of lipoprotein and apolipoprotein in 3 study groups as per birth weight.

Parameters	Group-I (n=32)	Group-II (n=152)	Group-III (n=16)	Total (n=200)	Sig. (p-value)
Apo A1	53.56±20.25	58.88 ±22.82	53.50±28.44	57.60±22.79	0.610*
Apo B	21.62±15.98	19.11±6.52	16.98± 3.36	19.34±8.55	0.409*
Atherogenic index (ApoB/ApoA1)	0.40±0.78	0.32±0.28	0.31±0.11	0.33±0.37	0.225*
Total Cholesterol (TC)	70.69±15.78	58.43±15.87	68.00±22.92	61.16 ±17.02	0.015**
TG	40.44±21.93	55.45±21.23	67.25±24.11	53.99±22.38	0.010**
HDL	25.19±10.77	18.28±8.53	19.12±15.48	19.45±9.80	0.036**
LDL	41.81±8.15	35.47±10.97	41.38±11.57	36.96±10.85	0.050**
VLDL	6.81±3.88	5.55±4.34	7.50±3.33	5.91±4.22	0.302*
*Statistically non-significant, **Statistically significant, Group-I <2500g, Group-II 2500-4000g, Group-III >4000g					

Out of 102 male newborns, 70.6 % mothers were physically active and 29.4% were sedentary, 29.4% mothers were having low socio-economic status and 70.6% had middle socio-economic status, 90.2% were term gestation newborns and 9.8% were pre-term newborns,76.5% were born through normal mode of delivery and 23.5% through casserian section compared with 98 female newborns were 87.8% were active and 12.2% sedentary mothers,49.0% mothers were having low socio-economic status and 51.0% had middle socio-economic status, 98.0% were term gestation newborns and 2.0% were pre-term newborns,89.8% were born through normal mode of delivery and 10.2% through caesarean section which was statistically significant ($p<0.05$). Also, when the comparison of occupation and order of issue between mothers of male newborns with mothers of female newborns was statistically insignificant ($p>0.05$) as shown in Table 1.

Out of 200 newborns102 were males and 98 were females. Statistically significant difference was seen in parameters Apo A1, Apo B, Atherogenic index (Apo B/Apo A1) and LDL between the genders rest of the parameters were statistically insignificant as shown in Table 2.

Also 32 newborns (16.0%) had <2500, 152 (76.0%) new born had 2500-4000 and 16(8.0%) >4000 grams birth weight. The mean lipoprotein and Apo-lipoprotein levels in these new born were compared between the groups as shown in Table 3.

The mean serum levels of TC, TG, LDL and HDL were statistically significant (<0.05) between the three groups were as Apo A1, Apo B, Atherogenic index (Apo B/Apo A1) and VLDL was insignificant (>0.05) respectively.

DISCUSSION

Estimation of cord blood lipoproteins and apolipoproteins in newborns could be predictive for lipoprotein disorders and cardiovascular diseases (CVD) in adulthood since low birth weight (LBW) is an important risk factor for CVD and other non-communicable diseases. This study showed that the cord blood lipid profiles in male and female newborns were not significantly different from each other; but higher values of total cholesterol, TG, HDL, and VLDL were noted in the male neonate. This was in concordance with few other studies including Anderson et al and Tsang et al which showed no significant changes in the cord blood lipid profile in terms of gender.[12,13] However, LDL levels were higher in male newborns than female which is in contrast with study by Esfarjani SV et al.[14]

It is well-recognised fact that low Apo A1 and/or increased Apo B are associated with increased cardiovascular risk. Elevated Apo B levels and raised Atherogenic index (AI) in young adults are linked with cardiovascular disease in later life.[15] In present study Apo A1levels in cord blood were higher in female newborns as shown in study by Bastida S et al, and Apo B and Atherogenic index was higher in male counterparts which

was not in accordance of Kharb et.al who showed more levels in female neonates.[16,17]

Birth weight is an amount of fetal growth which summaries body size, body length and subcutaneous fat. Studies have shown that newborns that have a low birth weight at birth tends to develop metabolic syndrome, hypertension, hyperinsulinemia, dyslipidemia and obesity in adult life.[18] In the present study Apo A1, Apo B levels and atherogenic index had non-significant association with birth weight of all the three groups. As reported by Radunovic et al. who had higher Apo B levels and Atherogenic index in low birth weight (LBW) newborns as compared to normal newborns, present study showed the similar results.[19] Total cholesterol, LDL, and HDL levels in LBW (group-I) and high birth weight(group-III) newborns were significantly higher than in normal weight (group-II) newborns were as TG and VLDL were significantly higher in (group-III) neonates (Table 3).This proves that fetal growth retardation establishes a lifelong irreversible atherogenic process and male newborns with low birth weight tends to have higher atherogenic profile.

CONCLUSION

CVD being a leading cause of morbidity and mortality in the developing countries, early screening of the at risk babies i.e. low birth weight newborns using cord blood lipoproteins and apolipoproteins levels helps in primordial and primary prevention of diseases. Also, many adult diseases, including metabolic syndrome, hypertension, hyperinsulinemia, dyslipidemia and obesity begin in early neonatal life and collected risk factors path to adulthood. So, these factors can be altered and can be modified by early lifestyle interventions particularly in male newborns. Since the development of vascular damage is not a onetime affair and needs long term environment for a disease to the process, it opens up new opportunities to proceed for further research to track the lipid levels of the newborns with respect to weight at the time of birth and note the gender predisposition.

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