Short Communication

Comparison of Cord Blood Atherogenic Index in Males and Females

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Background: A strong independent relationship has been observed in epidemiological studies between serum cholesterol and coronary heart disease.
Method: Study group consisted of 100 healthy newborns and hundred healthy volunteers (age group 18-25 years) served as controls. Samples were analyzed for lipid profile (total cholesterol, triglycerides, HDL cholesterol, VLDL cholesterol, and LDL cholesterol), apolipoproteins: ApoA-I, ApoB. Atherogenic index (A.I.) was calculated as ratio of Apo-B to ApoA-I.
Results: Lipid profile parameters were significantly lower in cord blood as compared to adults (P<0.001), cord blood of female newborns had higher total cholesterol (T-C), HDL-C, LDL-C Apo A-I, Apo B and A.I. as compared to male newborns, whereas triglycerides and VLDL–C were higher in male newborns.
Conclusion: Gender-related factors might influence lipid levels and the pathological processes for CVD and its risk factors have been rooted in childhood which can change favorably in youth with lifestyle modifications and obesity reduction.

Keywords: cord blood, lipid, lipoprotein, apolipoprotein, atherogenic index

Introduction

A fetus needs a considerable amount of cholesterol for development of tissues and organs. And after birth, human lipid transport system is transformed from one containing low VLDL and LDL levels to adults system with a relatively high LDL level which continues to increase with age. Cord sera have been demonstrated to contain all well-characterized adult lipoproteins and apolipoproteins.[1]

Apo-B / Apo A-I ratio is found to track closely during the first year of life. Abnormal lipoprotein profiles in childhood persist into adult life and elevated apo B levels in young adults have been linked to atherosclerosis in later life.[2] Fetal growth restriction is associated with a chronic pattern of atherogenic lipoprotein metabolism. Abnormal lipoprotein profiles in childhood persist into adult life and elevated apo B levels in young adults have been linked to atherosclerosis in later life.[2]

Elevations in LDL-C, total cholesterol (T-C) and apo-B levels in young adults have been linked with CVD in later life.[2] Studies by Dirisamer et al[3] gave evidence that levels of apo-B, Apo B/Apo A-I ratio as well as LDL-C concentrations are sensitive indicators for later coronary heart disease in children. Apo-B/ Apo A-I ratio, the most sensitive atherogenic index, is found to track closely during first year of life.[4] Screening patients for Apo A-I and apo-B levels may significantly improve ability to properly evaluate individual CAD risk beyond LDL-C measurement.[5] Hence the present study was planned to analyze cord blood and adult lipoproteins, apolipo-

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proteins, atherogenic index and compare them in males and females.

Patients and Methods

The present study was conducted in the Department of Biochemistry in collaboration with Department of Obstetrics and Gynecology, Pt.B.D.Sharma PGIMS, Rohtak (India).Study group consisted of 100 healthy newborns (following healthy normotensive pregnancy and normal term-delivery, group I) and hundred healthy volunteers (age group 18-25, vegetarian healthy volunteers with no history of alcoholism, smoking, hypertension, thyroid disorders, obesity, diabetes and renal diseases, group II) served as controls.

Ten ml cord blood was collected from placental end of umbilical vein of healthy new borns and ten ml venous blood was collected from healthy volunteers. Serum was separated by centrifugation and analyzed on the same day for lipid profile (total cholesterol, triglycerides, HDL cholesterol, VLDL cholesterol, LDL cholesterol), apolipoproteins: ApoA-I, ApoB [6-11]). Atherogenic index (A.I.) was calculated as ratio of Apo-B to ApoA-I.[12]

Data thus obtained were computed as mean ± S.D along with student's t-test and regression analysis.

Results

Cord blood of female newborns had higher total cholesterol (T-C), HDL-C, LDL-C Apo A-I, Apo B and A-I as compared to male newborns, whereas triglycerides and VLDL –C were higher in male newborns.

In case of adults, total cholesterol triglycerides, HDL-C, VLDL-C, LDL-C levels were higher in females as compared to male counterparts (Fig. 1).

Apo A-I, Apo-B levels and A.I were higher in adult males as compared to females (Fig. 2).

TC, LDL-C, triglyceride, Apo-B were significantly higher in adults as compared to newborns (36%, 31%, 28% and 41% of adults values respectively). Corresponding values of VLDL-C, HDL-C, Apo A-I in cord blood were 55%, 52% and 60% of adults values. Atherogenic index in newborns was 60% of that of adult serum.

Discussion

Major lipoprotein in cord blood is HDL-C, whereas LDL-C is the major cholesterol in adults.[13] Evidences suggest that maternal lipoprotein levels particularly those due to diet or induced by pregnancy influence cord blood lipid levels.[13] Placental insufficiency and other condition affecting fetal growth and mode of delivery may also influence cord lipoprotein concentrations.[14] In the present study, cord blood samples were taken from normal healthy term delivery so that foregoing factors did not interfere with our results.

TC, HDL-C and LDL-C in female cord blood were significantly higher as compared to male cord blood values. On the other hand, triglycerides and VLDL–C were high in male cord blood as compared to female cord blood, but the difference was not statistically significant. Our findings are in agreement with those reported in literature.[13,15] These findings

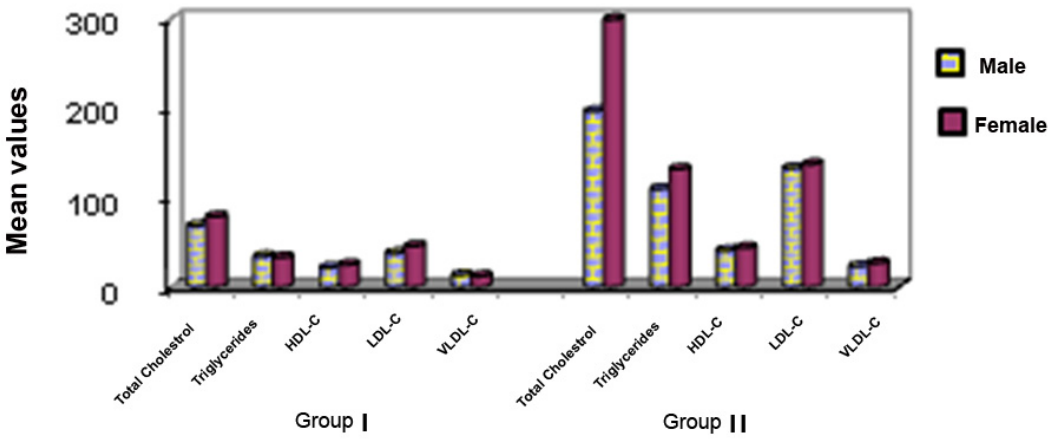

Figure 1. Lipid profile in two groups

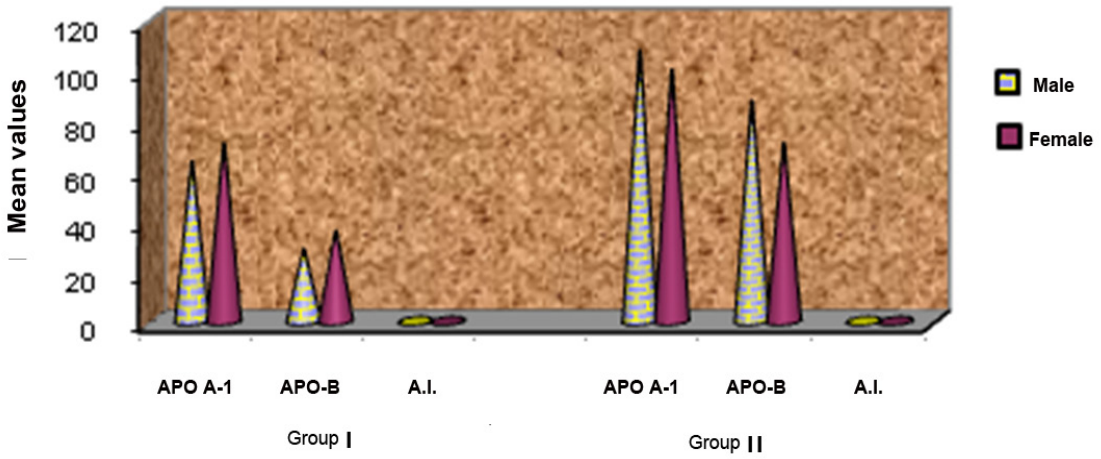

Figure 2. Apolipoproteins in two groups.

suggest that gender-related factors might influence lipid levels at term period. Our findings are in agreement with those of Badiee et al[13] in a population of Iranian term newborns where female neonates had significantly higher concentration of TC and HDL-C than males with TG levels in boys and girls being 61 mg/dl and 62 mg/dl respectively. Our findings are similar to those reported in literature.[13,15] Age- and gender- based differences in cord serum lipids in Toledo study showed higher TC, LDL-C levels in females with the exception of TG which was significantly raised in term males and females, with other lipoproteins remaining constant.[15] The different levels of TC and LDL-C and cholesterol distribution for lipoproteins in male and female cord blood suggest that gender-related factors might influence lipid levels at term period.[15]

In the present study, TC, HDL-C, LDL-C, VLDL-C and TG were higher in young healthy females as compared to healthy males, though the difference was not statistically significant. McConathy et al have reported high TG levels in males and low TC and free cholesterol levels in males than those seen in females.[1] Low levels of cholesterol in cord blood of males as compared to females have been reported by Barnes et al and Biezenski et al.[16,17] In this connection, our findings are in agreement with those reported elsewhere.[3,18] Dirisamer et al reported higher HDL-C concentration in males as compared to females, and TC, LDL-C, TG, Lp(a) were higher in females as compared to males in the age group of 3-18 years.3 On the other hand, Jungner et al reported that lipoprotein profile in males was more atherogenic than in females, particularly, TG and Apo-B were higher in males than in females, whereas HDL-C and Apo A-I were lower.[18] Also, LDL-C/Apo-B ratio was significantly lower in males than in females.

Several studies have demonstrated that low Apo A- I and / or increased Apo-B are associated with increased cardiovascular risk.[2,3,18] In the present study, Apo A-I, Apo-B and Apo-B /Apo A-I ratio (Atherogenic index, A.I.) were higher in female cord blood as compared to males.

All well-characterized adult apolipoproteins with reduced apo-B have been detected in cord blood.1Also, a significant correlation was found between Apo A-I and HDL-C, Apo-B and LDL-C in cord blood which is consistent with those of other studies.4 Gender-based differences in lipoprotein metabolism have been reported to be implicated in lipoprotein metabolism.[13,14,16] A great increment on cardiovascular risk is linked to these abnormalities in women.

Fetal growth retardation establishes a life-long irreversible atherogenic profile and men with low birth weights have been reported to have an atherogenic profile and have an atherogenic lipoprotein profile.[18] In the present study, all males were healthy newborns following term delivery and showed no correlation of lipid profile and lipoprotein levels with birth-weight. A.I. showed positive correlation with birth weight [r=0.046, P>0.05]. Few reports have demonstrated that abnormal lipoprotein profiles in childhood persist into adult life.[19,20]

There are relatively low VLDL and LDL levels in adult system with a relatively high LDL level which continues to increase with age.[1]

However high apo-B/ Apo A-I ratio, the most sensitive A.I, is found to track closely during the first year McConathy et al[1] reported presence of all well-characterized adult apolipoproteins in cord blood, with apo B levels most reduced. In the present study, we also observed that apo B level were most reduced of the apolipoprotein parameters in cord blood. A.I. was higher in cord blood of female newborns as compared to their male counterparts (P<0.001).

Fetus needs a considerable amount of cholesterol for development of tissues and organs, there should be no excessive cholesterol.[21] After birth, human lipid transport system is transformed from one containing relatively low VLDL and LDL levels to adult system with a relatively high LDL level.[22]

Sex differences are observed in animal models of fetal programming and recent studies suggests sex hormones modulate activity of regulatory systems leading to a lower incidence of hypertension and vascular dysfunction in females compared to males. A role for sex hormone involvement is strongly suggested with the response of regulatory systems critical to the long-term regulation of arterial pressure exhibiting increased sensitivity to sex hormones within the adult fetal programmed animal.[23]

Epidemiological and experimental studies suggest that the in utero environment plays a critical role in the development of adult disease, including cardiovascular disease and hypertension. This raises an interesting question: could fetal programming be sex specific and whether differences in sex in fetal programming play a role in the development of adult hypertension.[24]

Thus, atherogenic milieu occurring during pregnancy persists into adulthood and fetal growth retardation is strongly associated with adult atherosclerosis and atherogenic profile which is different in males and females since in utero.

Future studies are required to dissect out the mechanisms involved in initiating programming events in utero, as well as events secondary to the development of hypertension for the development of novel, potentially sex-specific strategies for prevention and treatment of hypertension.

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