LIPID PROFILE IN RDS GROUP AND NON-RDS GROUP: A COMPARISON STUDY

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ABSTRACT

Lipid metabolism has an important role in fetal development during the late stage of gestation including growth and fat accretion in utero, increasing amniotic fluid lecithin levels with maturation of pulmonary function and changes in the levels of minor phospholipids in amniotic fluid.

OBJECTIVE

The aim of this study was to compare cord lipid profiles of preterm infants with Respiratory Distress Syndrome (RDS) and a control group without RDS.

METHOD

The study groups consisted of 56 preterm infants with gestational ages ranging from 28 to 36 weeks and birth weights ranging from 0.8 to 2.26kg. Of these infants, 29 developed RDS and 27 infants served as controls. Cord blood lipid profile was done in both the groups and compared.

RESULT

Total cholesterol, high-density and Low-Density Lipoproteins (LDL) cholesterol levels were lower in infants with RDS than in controls ($P < 0.05$).

CONCLUSION

RDS is accompanied with lipid alteration in infants.

KEYWORDS

Serum Lipid Levels, Respiratory Distress Syndrome, Preterm Infants.

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INTRODUCTION

Cholesterol was found to represent over 50% of the neutral lipid of both the total surfactant and the lamellar body fractions and de novo synthesis of cholesterol from acetate accounted for only 1% of the surfactant cholesterol, the remainder being derived from exogenous cholesterol supplied as serum lipoproteins.¹⁻⁶ The function of cholesterol in surfactant has not been established; however, it is believed to facilitate spreading of dipalmitoyl phosphatidylcholine at the air-liquid interface in the lung, lowering surface tension.^{1,2} Hass et al.³ suggested that lung cholesterol metabolism might be subject to regulation by both Low-Density Lipoprotein (LDL) and High-Density Lipoprotein (HDL). The infants who subsequently developed respiratory distress had significantly

lower lipoprotein levels than the levels in normal new-borns and in preterm infants without respiratory distress after delivery.⁶

Additionally several factors significantly affected cord serum levels, especially gestational age and birth weight.^{4,5} Lipid metabolism has an important role in fetal development during the late stage of gestation including growth and fat accretion in utero, transport of cholesterol to the fetal adrenal for hormone synthesis, increasing amniotic fluid lecithin levels with maturation of pulmonary function and changes in the levels of minor phospholipids in amniotic fluid. A deficiency or reduced transport of essential and/or long-chain polyunsaturated fatty acids, which resulted in lipid alterations could inhibit normal fetal growth and maturation, one effect of which would be delayed development of the fetal lungs, which could lead to the Respiratory Distress Syndrome (RDS) post-natally.

MATERIALS AND METHODS

From January 2015 to September 2015, a total of 414 neonates were admitted to the neonatal intensive care unit. The inclusion criterion at admission was preterm infant whose gestational age is between 28 and 36 weeks. The exclusion criterion at admission were large or gestational age, asphyxiated at birth and major congenital anomalies.

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Mothers whose pregnancies were complicated by hypertension and pre-eclampsia or with maternal history of endocrine disorders such as diabetes, hypercholesterolaemia, thyroid or adrenal problems or who had received alcohol were excluded. Infant whose mother was taking drugs affecting the lipid metabolites, such as steroid (Except for fetal lung maturation) and Ritodrine were excluded from the study. We aimed to minimize the effect of the intrauterine environment on lipid profile. Total 56 infants were included in the study. Informed consent was obtained from the parents before enrolment and the project was approved by Hospital Committee for Research on Human Subjects. The presence of antenatal corticosteroid administration, gender, gestational age, birth weight, height, ponderal index, length, mode delivery, Apgar scores and mode of delivery were recorded for each infant. The infant's gestational age at birth was calculated from the date of the last menstrual period and confirmed by ultrasonography. After an infant met admission criteria, the diagnosis of RDS was established by meeting the following criteria: physical examination notable for chest wall retractions and cyanosis on room air, compatible x-ray demonstrating diffuse alveolar atelectasis, arterial blood gas documentation of metabolic acidosis, hypoxaemia and hypercapnia.

Control infants met all admission requirements, but did not develop respiratory distress. RDS was further graded by down scoring into mild,⁽¹⁻³⁾ moderate,⁽⁴⁻⁶⁾ and severe.⁽⁷⁻¹⁰⁾ Cord blood samples were obtained from umbilical vein immediately after delivery and allowed to clot at room temperature for 20

min. Serum was separated by centrifugation (20min, 2500 rpm) and kept at analysis was done. Serum triglycerides, total, HDL, LDL and VLDL cholesterol concentrations were measured using standard enzymatic methods with a fully automated analyzer. Results are presented as mean and SD. Unpaired 't' test was used to compare the means of two groups. One way ANOVA was for multiple group comparisons. A P value of 0.05 or less was considered for statistical significance. SPSS (version 17) software was used for data analysis.

RESULTS

The study groups consisted of 56 preterm infants with gestational ages ranging from 28 to 36 weeks and birth weights ranging from 800gm to 2200g. Of these infants, 29 developed RDS and 27 infants served as controls. Mean total, HDL, LDL, VLDL cholesterol and triglyceride levels were significantly lower in all gestational age groups of the infants with RDS than in the controls ($P < 0.05$).

Variables	RDS		Non-RDS		RDS v/s Non-RDS		
	Mean	SD	Mean	SD	Mean Diff	t	P
Tg	42.32	21.42	72.00	38.73	29.68	3.58	0.001*
LDL	44.74	17.88	52.99	19.40	8.24	1.66	0.10, ns
VLDL	21.09	12.80	29.97	13.01	8.88	2.57	0.013*
HDL	30.92	6.48	39.14	11.71	8.23	3.29	0.002*
TC	114.01	31.43	130.46	24.19	16.45	2.18	0.033*

Lipid profile in RDS and Non-RDS

Unpaired 't' test

* $P < 0.05$, S

$P > 0.05$, not sig

Lipid	GA (Wks.)	RDS		Non-RDS		Overall	
		Mean	SD	Mean	SD	Mean	SD
Tg	28	16.9	7.4	32.0	4.1	22.4	9.8
	30	28.0	.	89.5	64.0	80.7	62.8
	32	51.3	15.1	69.4	7.6	59.3	15.2
	34	46.9	20.2	67.6	3.6	56.0	18.3
	36	65.7	8.1	106.7	54.9	86.2	41.7
	F	7.91	-	2.45	-	6.81	-
	P	0.00**	-	0.08, ns	-	0.00**	-
LDL	28	25.3	3.8	31.8	1.3	27.6	4.4
	30	34.0	.	36.8	7.9	36.4	7.3
	32	55.1	10.4	68.1	19.6	60.8	16.0
	34	55.6	13.4	63.0	12.2	58.8	13.0
	36	30.0	23.4	55.2	17.3	42.6	23.0
	F	9.35	-	7.59	-	13.54	-
	P	0.0**	-	0.001*	-	0.00**	-
VLDL	28	4.0	1.7	9.9	1.7	6.2	3.4
	30	5.0	.	34.0	12.4	29.8	15.7
	32	27.9	8.1	25.5	10.5	26.8	9.0
	34	29.0	8.9	38.9	7.0	33.3	9.3
	36	22.0	8.0	38.3	5.7	30.2	10.9
	F	15.12	-	8.01	-	14.59	-
	P	0.00**	-	0.00**	-	0.00**	-
HDL	28	25.1	2.8	33.0	3.8	27.9	5.0
	30	30.0	.	30.4	3.8	30.4	3.4
	32	32.2	6.4	34.1	8.3	33.0	7.1
	34	34.6	5.6	52.6	11.6	42.5	12.5
	36	30.0	9.2	45.2	5.1	37.6	10.6
	F	2.9	-	8.63	-	5.48	-
	P	0.04*	-	0.00**	-	0.001*	-
TC	28	92.1	21.0	102.8	6.7	96.0	17.5
	30	95.0	.	117.5	17.5	114.3	18.1
	32	126.4	20.0	143.9	12.4	134.1	18.8
	34	128.1	29.9	131.9	25.3	129.8	27.1
	36	91.7	56.1	158.7	23.2	125.2	53.1
	F	2.62	-	5.66	-	4.02	-
	P	0.06, ns	-	0.003*	-	0.007*	-

One Way ANOVA, * $P < 0.05$, S, ** $P < 0.001$, HS

Lipid Profile with increasing Gestation

Lipid	Severity of Distress	Mean	SD
Tg	Mild	63.3	4.9
	Moderate	39.3	17.3
	Severe	22.3	15.2
	F	22.12	-
	P	0.00**	-
LDL	Mild	62.6	3.8
	Moderate	38.9	16.0
	Severe	31.3	13.1
	F	17.70	-
	P	0.00**	-
VLDL	Mild	34.3	3.4
	Moderate	18.1	9.3
	Severe	9.6	9.2
	F	25.104	-
	P	0.00**	-
HDL	Mild	36.9	2.9
	Moderate	30.5	5.7
	Severe	24.7	3.3
	F	20.06	-
	P	0.00**	-
TC	Mild	145.7	6.5
	Moderate	103.3	30.4
	Severe	90.7	19.0
	F	18.02	-
	P	0.00**	-
One Way ANOVA			
* P < 0.05, S			
** P < 0.001, HS			
Severity of Distress and Lipid profile in RDS			

Lipid	Neonatal Wt. (Kg)	Mean	SD
Tg	< 1.0	16.7	6.4
	1.0- 1.5	43.3	20.4
	1.5- 2.0	46.2	21.9
	2.0- 2.5	60.0	-
	F	1.99	-
	P	0.14, ns	-
LDL	< 1.0	24.0	5.3
	1.0- 1.5	48.5	15.9
	1.5- 2.0	48.3	17.4
	2.0- 2.5	15.0	-
	F	3.26	-
	P	0.03*	-
VLDL	< 1.0	4.1	2.5
	1.0- 1.5	22.3	14.2
	1.5- 2.0	24.6	9.9
	2.0- 2.5	14.0	-
	F	2.57	-
	P	0.08, ns	-
HDL	< 1.0	23.5	2.7
	1.0- 1.5	30.4	4.7
	1.5- 2.0	34.2	6.6
	2.0- 2.5	20.0	-
	F	4.66	-
	P	0.01*	-
TC	< 1.0	80.0	10.0
	1.0- 1.5	124.2	24.7
	1.5- 2.0	117.5	29.9
	2.0- 2.5	41.0	-
	F	4.95	-
	P	0.008*	-
One Way ANOVA			
* P < 0.05, S			
Neonatal Weight and Lipid profile in RDS			

DISCUSSION

Factors during pregnancy and delivery as well as certain diseases can influence fetal and neonatal lipid metabolism.^{6,7,8} In agreement with our findings, Lane et al.⁵ found that preterm infants developing respiratory distress post-natally had significantly lower cord serum lipid levels than those of normal term infants or preterm infants free of respiratory distress. Significantly lower cord serum lipid levels are evidence of reduced essential fatty acids and long-chain polyunsaturated fatty acid supply, which could inhibit fetal growth in utero delaying maturation of fetal lungs. Wojcicka-Jagodzinska et al.⁹ speculated that a reduction in the cholesterol concentrations of amniotic fluid of hypertensive mothers in whose children the respiratory distress syndrome developed, might have a prognostic significance in the prediction of respiratory distress in early neonatal period.

Compared with the values of non-RDS infants, lower levels of cholesterol and HDL cholesterol found in infants with RDS indicated a limited ability to metabolize VLDL, probably related to lipoprotein lipase impairment. Reduced levels of serum HDL cholesterol found in infants with RDS and in their mothers suggest that it may have an important role on regulating surfactant synthesis. Voyno Yassenetskaya et al.¹⁰ demonstrated that both LDL and HDL cholesterol stimulate primary cultures of type II cells to secrete phosphatidylcholine, the major phospholipid component of pulmonary surfactant.

In conclusion, RDS is accompanied with lipid alteration in the infants. We suggest that cord or serum lipid levels might be with the potential to detect those infants at risk for RDS that develops post-natally.

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