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The Relationship between Serum Lipid Profile and Respiratory Distress Syndrome in Preterm Infants

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ABSTRACT

Background & Objective: There are variable results regarding lipid profile status in preterm infants with respiratory distress syndrome (RDS). We aimed to evaluate the relationship between serum lipids and RDS in preterm infants.

Materials & Methods: This cross-sectional descriptive study was conducted on preterm infants admitted to Hamadan Fatemieh and Besat Hospitals between the years 2018-2019. Each infant was evaluated regarding RDS severity, serum lipid profile, ventilator use, and length of hospital stay. SPSS 16 was utilized to analyze the data at a 95% confidence interval.

Results: Out of 294 neonates, 51% were male. The mean birth weight and gestational age were 1783.51 ±551.86 grams and 32.37 ± 2.46 weeks, respectively. Based on the severity of RDS, 9.1% were mild, 41.8% moderate and 49.1% were severe. In severe RDS, mean triglyceride, cholesterol and LDL were significantly higher and HDL lower than in mild RDS (P <0.001).

Conclusion: In preterm infants with RDS, there is a significant relationship between serum lipid profile and severity of RDS, and also there is a significant correlation between serum lipid profile and birth weight and gestational age of neonates.

Keywords: Preterm infant, Lipids profile, Respiratory distress syndrome, Gestational age

Introduction

The rate of preterm birth has increased in recent decades. Premature birth is one of the leading causes of infant mortality in the world (1). Causes of mortality in preterm infants include sepsis, asphyxia, respiratory distress syndrome, cold injury, intraventricular hemorrhage, necrotizing enterocolitis, congenital disorders such as congenital heart and neurological disorders, and metabolic and electrolyte disorders(2). Respiratory distress syndrome (RDS) is common in preterm babies due to a lack of lung surfactant, which leads to increased surface tension in the alveoli, resulting in microatelectasis and low lung volume (3,4). About 20% of infants with RDS develop chronic lung disease at an older age, and studies have shown that low gestational age and low birth weight increase the risk of RDS. Regarding the high mortality level due to RDS, it is important to pay attention to its risk factors. On the other hand, risk factors also affect the prognosis of patients at the time of admission (5). Fat metabolism plays an important role in fetal growth in the last stages of pregnancy, including the role of growth and increased fat in the uterus, transferring cholesterol to the fetus's adrenal gland to synthesize hormones, increasing the amount of lecithin in amniotic fluid that improves pulmonary function and changes in the number of minor phospholipids in amniotic fluid (6,7). Lipid metabolism plays an essential role in maintaining the body's physiological function. During the fetal period, normal lipid metabolism is important for maintaining normal fetal growth (8). At the same time, pulmonary function is set by both high-density lipoproteins (HDL) and low-density lipoprotein (LDL) (9). In addition, various factors affect the number of serum lipids in infants, especially the rate of pregnancy period and birth weight (10). Deficiency or reduction in transferring of long-chain or essentially unsaturated fatty acids that cause a change in lipids can make problems normal development of the fetus, and one of its effects is a delay in growth of the fetal lungs; It can cause postpartum respiratory distress syndrome (11). In recent years, numerous research has been done regarding new methods of treating infants with RDS, given that RDS is significantly affected by several factors, including serum lipids in infants, pregnancy age, and birth weight. Therefore, the present study was designed to investigate the relationship between serum lipids and the severity of RDS in preterm infants.

Materials and Methods

This was a descriptive cross-sectional study performed on 294 preterm infants who were born and admitted to Fatemieh and Besat Hospitals of Hamadan University of Medical Sciences between the years 2018 - 2019. All infants who were hospitalized in the neonatal intensive care unit for RDS were screened based on the determined sample size. Infants were included in the study based on inclusion and exclusion criteria. Inclusion criteria included preterm infants less than 37 weeks gestational age, no asphyxia at birth, and Apgar score more than 7 in 5 minutes of birth. Exclusion criteria included having major congenital anomalies and identification of a cause for respiratory distress other than RDS.

Before starting the study, the details of the process were explained to the parents and all parents signed written informed consent. After a full investigation of the family history, medical exams, and symptoms of RDS, blood samples were taken from the infants in the first 12 hours after birth to assess biochemical biomarkers, including total cholesterol (Chol), high-density lipoprotein (HDL), and low-density lipoprotein(LDL) and triglycerides (TG) and sent to the laboratory. After obtaining the results, RDS severity and inpatient outcome tests were examined in terms of serum lipid levels.

The diagnosis of RDS was made by a pediatrician based on clinical symptoms of respiratory distress in preterm infants (grunting, retraction, tachypnea, hypoxia, etc.), chest radiographs, and laboratory results. Discharge conditions for RDS include improvement in clinical signs of respiratory distress, lack of oxygen dependence, improvement in radiographic and laboratory symptoms, and appropriate breastfeeding. We used SPSS software version 16 to analyze the data and we used t-student, Mann-Whitney, one-way analysis of variance, Kruskal-Wallis, Spearman correlation coefficient, and Pearson correlation coefficient to determine the relationship, difference, and correlation between the study variables. We used Pearson. All analyzes were performed at a confidence level of 95% and the significance level was considered less than 0.05.

Results

A total of 294 premature infants with RDS were included in the study. The mean birth weight and gestational age were 1783.51 ±551.86 grams and 32.37 ± 2.46 weeks, respectively. 51% of the infants were boys. Based on the severity of RDS,

9.1% were mild, 41.8% moderate and 49.1% were severe. (Table 1).

Table 1. Basic characteristics of the study population

Variable	Frequency
Gestational age(week) mean±sd	32.27±2.46
Gender, n (%)	
Male	150(51.0)
Female	144(49.0)
Birth Weight(gr) mean±sd	1783.5±551.8
RDS n (%)	
Mild	27(9.1)
Moderate	123(41.8)
Sever	144(49.1)
Tg (mg/dl) mean±sd	59.35±20.95
Chol (mg/dl) mean±sd	17.67±19.96
LDL (mg/dl) mean±sd	49.40±21.97
HDL (mg/dl) mean±sd	35.23±10.83

A significant difference was observed between mild and severe RDS in terms of cholesterol, triglycerides, LDL, and HDL (P <0.05), but there was no significant statistical difference between mild and moderate RDS and moderate and severe RDS. In infants who used a ventilator, the mean triglyceride was significantly higher and the mean HDL was lower than in infants who did not use a ventilator. However, there was no statistically significant difference between the mean LDL and cholesterol (Table 2).

Table 2. Lipid profile according to RDS severity, ventilator use, and disease outcome

Variable	Tg Mean±SD	Chol Mean±SD	LDL Mean±SD	HDL Mean±SD
RDS Severity				
Mild	40.45±10.70	66.61±9.65	32.89±5.67	41.06±9.67
Moderate	59.12±17.13	75.32±20.17	47.98±22.95	37.08±11.29
Sever	60.85±23.84	80.75±20.48	54.18±22.89	31.34±9.34
Sig	0.001	0.011	<0.001	<0.001
Ventilator use				
Yes	66.12±27.04	80.10±21.12	54.78±24.88	31.26±9.28
No	55.72±27.93	76.18±19.59	47.92±21.74	35.79±10.94
Sig	0.002	0.234	0.055	0.010
Outcome				
Recovery	57.33±20.26	77.06±20.20	49.75±22.56	34.91±10.91
Death	71.22±27.33	78.53±17.33	47.18±25.98	30.85±6.86
Sig	0.021	0.798	0.695	0.189

In infants with RDS, a positive and significant correlation was observed between CPAP duration, length of hospital stay, birth weight, and gestational age with triple glyceride, cholesterol, and LDL levels, and a negative and significant correlation was observed with HDL level (Table 3).

Table 3. The correlation coefficient between Lipid profile and gestational age, birth weight, CPAP duration, and length of hospital stay

Variable	Tg	Chol	LDL	HDL
Gestational age				
R	-0.214	-0.246	-0.320	-0.284
Sig	0.002	<0.001	<0.001	<0.001
Birth Weight				
R	-0.247	-0.210	-0.260	-0.214
Sig	<0.001	0.003	<0.001	0.002
CPAP duration				
R	0.158	0.232	0.318	-0.231
Sig	0.03	0.002	<0.001	0.001
Length of hospital stay				
R	0.196	0.241	0.432	-0.232
Sig	0.007	0.001	<0.001	0.002

Discussion

In the present study, we evaluated the relationship between serum lipids and RDS severity in preterm infants, in terms of RDS severity, 9.1%, 41.8%, and 49% of infants had mild, moderate, and severe RDS, respectively. Our data showed that the mean triglycerides, cholesterol, and LDL in severe RDS were significantly higher than in mild RDS, and the mean HDL in severe RDS was significantly lower than in mild RDS.

In infants who used a ventilator, the mean triglyceride was significantly higher and the mean HDL was lower than in infants who did not use a ventilator. In addition, in infants who died, the mean triglyceride was significantly higher and the mean

HDL was lower than in patients who survived. In infants with RDS, a positive and significant correlation was observed between CPAP duration, length of hospital stay, birth weight, and gestational age with triple glyceride, cholesterol, and LDL levels, and a negative and significant correlation was observed with HDL level

In a study by Sanjay et al. in the field of changes in serum lipid profile in premature infants, a statistically significant difference was observed between RDS severity and lipid profile. Serum level of lipid was inversely related to RDS severity, as lipid profile lowers severity increases **(12)**. In our study, the mean serum HDL decreased with increasing RDS intensity, but contrary to the results of Sanjay et al.'s study, there was a direct relationship between RDS severity and LDL level.

In a study by Gunes et al, in comparing infants with RDS and a control group serum cholesterol, HDL, and LDL were lower in infants who had RDS, while no significant difference was observed in terms of serum TG and VLDL levels during the comparison between the control groups **(11)**. In our study, the lipid profile of term infants without RDS was not controlled.

Wang et al. demonstrated only lower TG level is observed in preterm infants with RDS **(13)**. A similar study by Donegá et al observed that triglycerides levels were lower in preterm infants compared to term infants **(14)**. These findings were in line with our results that TG level increased with gestational age.

Ghoor et al. study regarding the serum lipid's effect on patient survival in infants with hyperglycemia with multiple organ disorders, including respiratory distress, blood transfusion reduced triglyceride levels, and significantly improved patients **(15)**. In the current study, instead of calculating the 28-day survival, only hospital mortality was assessed in which the survived infants had a significantly lower mean of triglyceride and higher HDL compared to dead infants.

The results of several studies show that the amount of LDL is significantly increased in preterm infants. In addition, concerning the field of relationship between gestational age and birth weight with infants' lipid profile **(9)**. In our study, a negative and significant correlation between the birth weight of preterm infants with triglyceride, cholesterol, and LDL and a positive and significant correlation with HDL was observed. In contrast, Donegá et al. reported that birth weight did not affect fat density in infants **(14)**. Moreover, a study carried out by Tohmaz et al., which was stated that preterm infants have higher cholesterol density compared to term infants **(16)**. On the other hand, Wang et al. showed only a lower TG value was observed in preterm infants between 28-30 weeks with RDS **(13)**. Ghaemi et al. also reported that TG level in preterm infants was higher than in term infants, but there was no significant relationship with HDL, and preterm infants with higher age had higher cholesterol density in placental blood compared to term infants**(17)**. Similarly, a study by Jain et al. showed a significant increase in LDL levels in preterm and term infants **(18)**. According to the results of the studies, the variety of serum lipids (LDL, HDL, Tc, and TG), the difference in sample size in different studies, and different methods (with or without a control group) may cause heterogeneity in results.

A study by Kelishadi et al. has shown that low gestational age may increase the chance of RDS by reducing lipid levels as well as surfactant production **(19)**. Other studies have also suggested that serum lipid levels may be associated with surfactant production, which may reduce the incidence of RDS **(20, 21)**.

Conclusion

In preterm infants with RDS, there is a significant relationship between serum lipid profile with RDS severity and its outcome, as well there is a significant correlation between serum lipid profile with birth weight and gestational age.

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Ethical Considerations:

The Ethics Committee of Hamadan University of Medical Sciences with the code IR UMSHA.REC.1397.185 approved the study. Written informed consent was obtained from the parent of the patient who participated in this study.

Conflict of Interest

The authors declare that they have no conflict of interest.

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