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Original Research Article

Gestational Age versus Weight on Lipid Profile in Neonates: A Prospective Research from a Tertiary Health Care Setup

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Abstract

Introduction: The surge in coronary heart diseases (CHD) underscores the need for early intervention, considering the fetal origins of these conditions. This study aims to measure cholesterol, triglycerides, HDL, and LDL in cord blood of term and preterm, appropriate for gestational age (AGA) and small for gestational age (SGA) neonates, seeking to identify early markers of cardiovascular risk.

Methods: A case-control study conducted at Maharajah's Institute of Medical Sciences, Vijayanagaram, over three years from 2016 to 2019. Institutional Ethics committee approval and parental consent were obtained. Random sampling included newborns from low socioeconomic backgrounds, whose mothers were on iron-folic acid supplements. Exclusions comprised congenital malformations and maternal health conditions. Clinical assessments, gestational age determination, anthropometric measurements, and cord blood collection were performed. Lipid profiles were analyzed enzymatically. Statistical analysis utilized SPSS, employing chi-square test, t-test, and contingency coefficient analysis with $p < 0.05$ significance level.

Results: Lipid profiles differed significantly between SGA and AGA newborn, with higher triglycerides and lower HDL in SGA. Preterm infants had elevated triglycerides, LDL, and VLDL compared to term infants. Total cholesterol showed no significant difference between groups.

Conclusion: Our study reveals notable lipid profile variations between preterm and term neonates, emphasizing the need for early assessment in neonatal care. Limited by a small sample size and single-center design, broader multicenter studies are needed to confirm these findings and delve into additional factors influencing neonatal lipid metabolism.

Keywords: Neonatal, Lipid profile, Preterm, Term, Assessment.

Introduction

The surge in coronary heart diseases (CHD) among both genders in early middle age, particularly in industrialized nations and also world epidemic. [1] Research suggests that the origins of these diseases may be rooted in fetal development, with adverse intrauterine conditions impacting cardiovascular health later in life. Studies have indicated a correlation between conditions like hypertension, dyslipidemia, and type 2 diabetes in adulthood and adverse fetal environments. [2] In India, where coronary artery disease rates have risen steadily over the past two decades, socio-economic factors exacerbate the situation, potentially leading to a higher number of cardiovascular-related deaths, especially among economically disadvantaged groups. [3]

Efforts to curb this epidemic necessitate early intervention, recognizing that risk factors for CHD can manifest in infancy and childhood. Cord blood screening offers promise in identifying individuals at risk, particularly for lipid profile abnormalities. Elevated levels of free fatty acids and triglycerides in newborns, exacerbated by adverse conditions, may indicate compromised fetal oxygenation.

Maternal and fetal risk factors, including maternal chronic diseases and complications during labor, further jeopardize fetal-placental function. Studies

have linked small-for-gestational-age (SGA) babies with abnormal lipid profiles, highlighting the potential for early detection of cardiovascular risk markers in preterm and SGA infants. [4]

Early identification of lipid profile abnormalities in high-risk neonates, coupled with appropriate dietary interventions and pharmacotherapy, presents an opportunity for primary prevention of cardiovascular diseases in adulthood. [5] Vigilant monitoring and targeted interventions from birth may mitigate long-term cardiovascular risks associated with adverse fetal conditions, offering a pathway to improved public health outcomes. The study aims to measure cholesterol, triglycerides, HDL, and LDL in cord blood of term and preterm, appropriate for gestational age (AGA) and SGA.

Methods

It was a case control study conducted in the department of paediatrics, Maharajah's Institute of Medical Sciences, Vijayanagaram. Study was conducted for a period of 3 years, from 2016 to 2019. Study protocol was approved by the Institutional Ethics committee. Informed written consent was taken from the parents. Random sampling was considered in this research.

Newborns of both gender, comprising booked and unbooked cases, belong to low socioeconomic backgrounds, with mothers on iron-folic acid (IFA) supplements were included in the research. Neonates with congenital malformations and those born to mothers with diabetes mellitus (DM), tuberculosis, asthma and pregnancy-induced hypertension, with family history of coronary heart disease, maternal medication use, drug abuse during pregnancy, instrumental delivery, and those diagnosed with sepsis were excluded.

A thorough clinical examination was conducted, and the baby's weight was determined using an electronic weighing scale. Newborns were classified based on gestational age (GA) using New Ballard's scoring. [6] Newborns were categorized into two groups based on birth weight: those weighing >2.5 kg and weighing < 2.5 kg, considering GA. Subsequently, newborn were further classified as SGA or AGA based on birth weight percentile charts. [7] Measurements including length, head circumference, chest circumference, and abdominal circumference were recorded, and ponderal index was calculated.

Cord blood samples (2.5 ml) were collected from the placental end of the cord immediately after delivery in plain, dry test tubes, and lipid profiles were assessed using enzymatic colorimetric method as per the institutional protocol.

Statistical Analysis: Chi-square test, t-test, and contingency coefficient analysis were employed for continuous variables using SPSS for Windows. A significance level of $p < 0.05$ was considered significant for the analyses.

Results

Lipid profiles compared between AGA (n=30) and SGA (n=70) newborn showed no significant difference in total cholesterol (P=0.238). Triglyceride (TG) was significantly higher in SGA (82.0±21.3 mg/dL) than AGA (63.9±23.5 mg/dL, P=0.0001), while HDL was significantly lower in SGA (28.6±7.8 mg/dL) compared to AGA (34.2±9.1 mg/dL, P=0.003). Whereas between the term (N=62) and preterm (N=38) newborn, no significant difference in total cholesterol (P=0.455). However, TGs were significantly higher in preterm infants (84.6±20 mg/dL) than term infants (71.7±24.1 mg/dL, P=0.007). LDL was significantly higher in preterm infants (54.9±24.6 mg/dL) compared to term infants (45.9±10.9 mg/dL, P=0.013). VLDL was significantly higher in preterm infants (16.9±4 mg/dL) compared to term infants (14.3±4.83 mg/dL, P =0.007).

Discussion

The lipid profile in newborn serves as a critical indicator of metabolic health and development. [8] While newborn typically exhibit lower levels of total cholesterol and TGs compared to adults, these levels increase rapidly during the first few days of life. HDL cholesterol, known as good cholesterol, plays a vital role in transporting cholesterol from peripheral tissues to the liver for metabolism. Conversely, elevated LDL cholesterol and VLDL cholesterol levels may indicate increased risk for cardiovascular diseases later in life. Monitoring lipid profiles in newborn aids in early detection of metabolic disorders and guides interventions to promote long-term health outcomes. [9]

Numerous studies have demonstrated a direct correlation between lipid profile abnormalities in preterm and SGA neonates and the development of cardiovascular diseases. [10, 11] This study aimed to detect lipid profile abnormalities early, particularly at birth, in preterm and SGA neonates. The goal is to initiate vigilant monitoring of these high-risk infants to mitigate future health complications.

In this research, the correlation between total cholesterol levels and AGA versus SGA indicated no significant difference in. This suggests that birth weight and GA may not directly influence total cholesterol levels at birth. Further research is needed to elucidate other factors contributing to lipid metabolism in newborn and their potential implications for long-term health outcomes. TG levels in newborn is primarily utilized as biomarkers to assess lipid metabolism and metabolic health. Elevated TG levels may indicate metabolic disorders or conditions such as prematurity, SGA, or maternal diabetes. Clinicians may use TG measurements alongside other

lipid profiles to evaluate neonatal health and guide clinical management. [12]

Elevated lipid levels serve as significant risk factors for the onset of atherosclerotic cardiovascular disease (ASCVD) later in life. Research conducted in high-income nations has documented the continuity of individual risk factors, such as lipid profiles, from childhood into adulthood. [13] Hence, evaluating cardiovascular risk factors during childhood may be prudent. However, there is limited data on early-life lipid profiles in this country. [14] Data from an Indian study indicates that the average total cholesterol, HDL-cholesterol, LDL-cholesterol, and TGs measured [15] were nearly double compared to measurements from a comparable western population taken just after birth. Similar disparities were observed when comparing data from another Indian population to that of a western population. [16]

In this research, preterm infants exhibited significantly higher TGs (84.6±20 mg/dL vs. 71.7±24.1 mg/dL, P=0.007), LDL (54.9±24.6 mg/dL vs. 45.9±10.9 mg/dL, P=0.013), and VLDL (16.9±4 mg/dL vs. 14.3±4.83 mg/dL, P=0.007) levels compared to term infants. In their study, Jane Oba et al. [17] concluded that total cholesterol, LDL, and HDL values were notably elevated in preterm neonates (P<0.0001), while TG values were significantly lower (P<0.01).

In our study, the GA was determined to be 36.78±2.1 weeks, comparable to Pardo et al. study (35.57±0.11 weeks), as both studies encompassed both term and preterm SGA neonates. [18] Conversely, studies by Kelishadi et al. [19] and Wang et al. [20] reported higher GAs as they exclusively included term SGA neonates in their study cohorts.

In conclusion, our study highlights significant differences in lipid profiles between preterm and term neonates, with preterm infants exhibiting elevated LDL and VLDL levels and lower TG levels. These findings underscore the importance of early lipid profile assessment in neonatal care. However, limitations include the small sample size and single-center nature of the study, which may limit generalizability. Further research with larger cohorts and multicenter studies is warranted to validate our findings and explore additional factors influencing neonatal lipid metabolism.

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