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Original research article

Determinants of Hematological parameters in low birth weight babies

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Abstract

LBW is a complex term that comprises preterm neonates (born before 37 weeks of gestation), small for gestational age (SGA) neonates at term and the overlapping between these two situations – preterm, small for gestational age neonates, who characteristically have the poorest outcomes. There was daily visit to the Baby care clinic and postnatal care (PNC) ward. Neonates were examine in postnatal care ward & Baby care clinic and the parents were explain about the purpose of study. Those parents who satisfy inclusion criteria and ready for the study after counseling, their neonates were enrolled in the study and after taking informed consent from parents. Among males mean values of hemoglobin (13.9±1.8 gm/dl) was non- significantly lower comparing to females (13.2±1.8 gm/dl) (p>0.05). While mean values of total leucocyte count was non-significantly higher among males (8431.5±2566 per ml) comparing to females (7921.7±2497.5 per ml) (p>0.05).

Keywords: Determinants, hematological parameters, low birth weight babies

Introduction

The birth weight of an infant is the first weight noted after birth, preferably measured within the first hours after birth, before significant postnatal weight loss happens. As per the World Health Organization (WHO) definition, Low birth weight (LBW) has been defined as a birth weight of less than 2500 gm (up to and including 2499 gm). Worldwide, LBW continues to be a significant public health problem and related with a range of both short- and long-term consequences [1]. LBW is a valuable public health indicator of maternal health, nutrition, healthcare delivery, and poverty. Neonates with LBW have more than 20 times greater risk of mortality compared to neonates with birth weight of >2500 gm. Generally, it is assessed that 15% to 20% of all births worldwide are LBW, demonstrating more than 20 million births a year. There is a considerable variation in the prevalence of LBW in different regions and within countries; however, the great majority of LBW births are occurring in low- and middle-income countries and chiefly in the most vulnerable populations. Regional estimations of LBW include 28% in south Asia, 13% in sub-Saharan Africa and 9% in Latin America [2].

A full-term neonate is defined as infant who had completed 37 to 42 weeks of pregnancy. Neonates born before 37 weeks gestation are known as *premature* or *preterm*, however neonates delivered after 42 weeks are known as *post term* [3].

LBW is a complex term that comprises preterm neonates (born before 37 weeks of gestation), small for gestational age (SGA) neonates at term and the overlapping between these two situations – preterm, small for gestational age neonates, who characteristically have the poorest outcomes. These three groups have their own subgroups, with separate components connected to different causative factors and long-term effects, and distributions across populations that depend on the prevalence of the underlying causal factors. SGA (Small for gestational age) denotes newborns whose birth weight is less than the 10th percentile for gestational age. Understanding and differentiating the various categories and their subgroups is an essential first step in preventing this conditions [4, 5].

Low birth weight (LBW) is further classified into very low birth weight (VLBW, <1500 gm) and extremely low birth weight (ELBW, <1000 gm). It had been found that preterm – SGA (small for gestational age) birth is associated with chronic hypertension and pre-eclampsia/eclampsia. The exhibition of pre- eclampsia highlights the complex interaction that exists between nutrition, preterm birth and SGA. Pre-eclampsia that only occurs during pregnancy is related with both preterm birth (spontaneous or induced due to severe disease) and SGA babies, owing to reduced placental function, which comprises poor nutrients transfer to the fetus [6].

Term neonates lose weight between 3.5% and 6.6% of their birth weight within the first 2.5 – 2.7 days of life. Exclusively breastfed neonates have more weight loss (Median 6.6%, 95%CI 6.3 – 6.9%) than formula-fed (Median 3.5%, 95%CI 3.0–3.9%) or mixed fed (5.9%, 95%CI 4.8–6.9%) neonates respectively and take longer to regain their birth weight (8.3 vs. 6.5 vs. 7.9 days).

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Methodology
Study Design: Cross-sectional study.

Study Population: Low birth weight neonates of the 14 – 28 days age who have history of delivery after term pregnancy attending Hospital.

Sample Size: Total 245 LWB neonates were included.

Study tools: Pre designed semi-structured questionnaire

Study Periods
Data collected for a period of 2 years.

Sample size: Two hundred forty five cases meeting the criteria were included for the present study.

Sampling Technique: Convenient sampling methods.

Participant Enrolment
Inclusion criteria
- Term healthy low birth weight (LBW) babies of weight less than 2500 gm
- Term neonates of 2 to 4 weeks of age
- Exclusive breastfeed neonates

Exclusion criteria: Patients with below mentioned were excluded from the study
- Formula fed babies
- Mothers with RH incompatibility
- No history of NICU admission
- Mothers with post-partum hemorrhage

Consent
<18 years old – Parent's consent

Confidentiality of participants: All details were keeping by the investigator under strict confidentiality. Analysis was also anonymous and removed personal identifiers.

Method of collection of data
There was daily visit to the Baby care clinic and postnatal care (PNC) ward. Neonates were examine in postnatal care ward & Baby care clinic and the parents were explain about the purpose of study. Those parents who satisfy inclusion criteria and ready for the study after counseling, their neonates were enrolled in the study and after taking informed consent from parents. Around 2 ml of venous blood was collected from baby under aseptic conditions and the sample was send to the lab for analysis.

Results

Table 1: Age wise comparisons of neonates based on hematological parameters

Hematological parameters	Age		P values
	14-21 days	22-28 days	
Hemoglobin (gm/dl)	13.9±1.8	12.3±1.2	<0.001
Total leucocyte count (per ml)	8371.6±2719.2	7975.7±2303.1	0.226
Platelet count (lakh/ml)	2.85±0.90	2.81±0.80	0.726
PCV	42.7±5.8	37.5±4.0	<0.001
MCV (fl/red cell)	96.2±6.1	90.8±6.0	<0.001
MCH (pictograms/red cell)	35.2±3.7	33.8±2.5	0.001
MCHC (gm/dl)	34.6±2.7	33.5±1.5	<0.001

Mean values of hemoglobin was significantly higher in 14 - 21 days old neonates (13.9±1.8 gm/dl) comparing to 22 – 28 days old neonates (12.3±1.2 gm/dl) (p<0.05).
Mean values of total leucocyte count was non-significantly higher in 14 - 21 days old neonates (8371.6±2719.2 per ml) comparing to 22 – 28 days old neonates (7975.7±2303.1 per ml) (p>0.05).
Mean values of platelet count was also non-significantly higher in 14 - 21 days old neonates (2.85±0.9 lakh/ml) comparing to 22 – 28 days old neonates (2.81±0.8 lakh/ml) (p>0.05).

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Mean values of PCV was significantly higher in 14 - 21 days old neonates (42.7±5.8%) comparing to 22 – 28 days old neonates (37.5±4%) (p<0.05).
Mean values of MCV was significantly higher in 14 - 21 days old neonates (96.2±6.1 fl/red cell) comparing to 22 – 28 days old neonates (90.8±6 fl/red cell) (p<0.05).
Mean values of MCH was significantly higher in 14 - 21 days old neonates (35.2±3.7 picograms/red cell) comparing to 22 – 28 days old neonates (33.8±2.5 picograms/red cell) (p<0.05).
Mean values of MCHC was significantly higher in 14 - 21 days old neonates (34.6±2.7 gm/dl) comparing to 22 – 28 days old neonates (33.5±1.5 gm/dl) (p<0.05).

Table 2: Sex wise comparisons of neonates based on hematological parameters

Hematological parameters	Sex		P values
	Male	Female	
Hemoglobin (gm/dl)	13.1±1.8	13.2±1.77	0.648
Total leucocyte count (per ml)	8431.5±2566	7921.7±2497.5	0.117
Platelet count (lakh/ml)	2.86±0.88	2.80±0.83	0.627
PCV	40.3±5.8	40.4±5.6	0.934
MCV (fl/red cell)	93.4±6.9	94.1±6.4	0.443
MCH (pictograms/red cell)	34.5±3.3	34.7±3.4	0.599
MCHC (gm/dl)	34.0±2.2	34.2±2.2	0.605

Among males mean values of hemoglobin (13.9±1.8 gm/dl) was non- significantly lower comparing to females (13.2±1.8 gm/dl) (p>0.05).
While mean values of total leucocyte count was non-significantly higher among males (8431.5±2566 per ml) comparing to females (7921.7±2497.5 per ml) (p>0.05).
Mean values of platelet count was also non-significantly higher among males (2.86±0.88 lakh/ml) comparing to females (2.80±0.83 lakh/ml) (p>0.05).
Mean values of PCV was non-significantly higher in females (40.4±5.6%) comparing to males (40.3±5.8%).
Mean values of MCV was non-significantly higher in females (94.1±6.4 fl/red cell) comparing to males (93.4±6.9 fl/red cell).
Mean values of MCH was nearly same in both male (34.5±3.3 picograms/red cell) and females (34.7±3.4 picograms/red cell).
Mean values of MCHC was also nearly same in both male (34±2.2 gm/dl) comparing to females (34.2±2.2 gm/dl).

Discussion

Newborn baby represents the termination of developmental events from conception and implantation through organogenesis. The growing embryo necessitates red cells for the transport of maternal oxygen to for growth and development. After birth, dramatic changes were occurring in circulation and oxygenation that effects hematopoiesis, as the newborn has to makes transition to aseparate biological environment. During embryogenesis, hematopoiesis occurs in different sites, along with extra embryonic yolk sac, the fetal liver and the preterm bone marrow. Erythropoiesis establishes shortly after implantation of the blastocyst; with primitive erythroid cells appearing in yolk sac blood islands by day 18 of gestation [7].
Intense changes occur in the blood and bone marrow of the newborn infant during the first hours and days after birth and there are rapid fluctuations in the quantities of all hematologic components. It was found that the values of most of the hematological parameters studied were highest mainly hemoglobin concentration, reticulocyte count, packed cell volume (PCV) and red cell indices on the first day of life and thereafter declined over the third day and the sixth week of life as shown in figure 1 & 2. This decline in hematological parameters was also reported in other studies done in Nigeria. Similarly, Caucasian infants had also showed the same pattern of steady decline in the hemoglobin concentration [8].
Factors responsible for reduction in hematological parameters in the newborn are decrease in blood erythropoietin concentration shortly after birth, reducing the erythropoietin rate. After birth, polycythemic condition develops due to decreasing in fetal Hb (HbF), an increase in adult-type Hb (HbA), higher environmental oxygen concentrations and hemoglobin oxygen saturation promotes increased tissue oxygenation and thus decreases the stimulation of erythropoietin production reducing erythrocyte release. However, temporary hemolysis was higher during the first days or weeks after birth as during the rest of healthy life. This temporary hemolysis is a common physiologic event during the first week after birth similar to neocytolysis a rapid decrease in hemoglobin, because of hemolysis, seen in mountaineers after they descend to sea level after many weeks at high altitude. Significant hematologic differences are seen between term and preterm infants and among newborns, infants, young children and older children [9].
Considering the fact that preterm infants are born before their fetal storage is complete, they might

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develop an increased risk of iron deficiency and even anemia during the early postnatal period. Late-preterm (LPT) newborns although appear healthy but were premature and carrying all of the inherent risks, such as increased difficulty in the postnatal transition and a greater risk of neonatal morbidity compared to term newborns, in addition to a higher incidence of readmissions (approximately two times higher) and neonatal mortality [10].

Conclusion

No statistical difference were observed between males and females for hematological parameters like Mean value of hemoglobin, hematocrit, MCV, MCH and MCHC.

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