



Original Article

Cord blood Hemoglobin and Red Blood Cell Indices in Term, Term IUGR and Preterm Babies in Northern Kerala – A comparative study

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Abstract

Background: Cord blood Hemoglobin and Red Blood Cell Indices are frequently done in newborn babies as a part of routine evaluation. About one third babies are born pre term in India.

Objectives: This study was undertaken to establish the reference values of Hemoglobin & Red blood cell indices among Term babies with normal birth weight, Term Intra uterine growth restricted babies (Term IUGR) and preterm babies, and to compare the values each other to find out any significant difference.

Materials and Methods: Umbilical cord sample were taken from 210 babies, 70 of them belongs to each group, Hemoglobin and Red Blood Cell Indices detected. The data obtained was analyzed with SPSS version 16.

Results and Conclusion: Mean Hb and haematocrit values were lowest in preterm babies and highest for term IUGR babies. There is statistically significant increase in RBC count as the gestational age increases. There is further increase in RBC count in term IUGR babies. MCV and MCH were more preterm babies when compared term babies. MCHC is more in preterm babies and significant increase in RDW in term IUGR babies. The reference values obtained can be used as background data for proper management of neonatal period.

Keywords: Red blood cell, term, preterm, intra uterine growth restriction., hemoglobin, RBC indices.

Introduction

Birth weight is an important determinant of an infant's survival and future development.¹ Low birth weight (LBW) is defined as weight less than 2500 grams at birth regardless of gestational age.² LBW puts a newborn at increased risk of death and illness and limits their growth potential in the

adulthood. Globally, LBW contributes to 40–60% of newborn mortality. LBW can be caused by preterm birth or by intrauterine growth restriction. The latter group is also referred to as small for gestational age (SGA) babies.² Both groups are associated with increased neonatal mortality and morbidity.³

A baby delivered after 37 completed weeks of gestation is called term baby and before 37 completed weeks is called preterm baby.³ Term baby with a birth weight of less than 2500gms at birth is called term IUGR (intra uterine growth restriction). Intrauterine growth restriction has been defined as the rate of fetal growth that is below normal in light of the growth potential of a specific infant as per the race and gender of the fetus.⁴ It has also been described as a deviation from or a reduction in an expected fetal growth pattern and is usually the result of innate reduced growth potential or because of multiple adverse effects on the fetus. The “normal” neonate is the one whose birth weight is between the 10th and 90th percentile as per the gestational age, gender and race with no feature of malnutrition and growth retardation.⁴

The hematological profile of an individual to a large extent reflects his or her general health.⁵ Complete blood count determinations are frequently done in newborn babies as a part of evaluation of infection, jaundice and pallor. Defining normal hemoglobin and other RBC indices are more critical in new born babies when compared to older children and adults. The values occurring in term infant may not be applicable to a preterm infant. For example hematocrit of 38% is within the expected range for an infant born at 24 weeks of gestation. The same value is abnormal and suggests anemia in a term baby.

Keeping in pace with the global development in medicine, the laboratory medicine also witnessed tremendous development in techniques and equipments. This facilitated easy and accurate estimation of various tests. Instead of older haemoglobinometer, fully automated haematological analysers are available which requires less amount of blood and gives results as a print out. This is particularly important for a newborn baby where repeated phlebotomies for investigation may led to anemia. The marked improvement in neonatal care during the past decades resulted survival of large number of preterm and IUGR babies.

Since the assessment of hematological status is possible through a series of tests measuring different variables, it is valuable to have norms for the hematological indices.⁶ Although profiles are generally available in the published literature as established norms, there is no evidence that any studies were done to assess the applicability of these norms across populations. Hence studies are relevant and needed to establish the normal values for hemoglobin and other RBC parameters in term, pre term and term IUGR babies in Northern Kerala population. The present study is done to compare cord blood Hb and other RBC parameters in term, term IUGR and preterm babies in Northern Kerala.

Material and Methods

This study was done to derive normal Hemoglobin and other Red Blood Cell indices in term, Preterm and term IUGR babies in northern Kerala. It was a cross-sectional study lasted for one year. The parameters studied were Hb, RBC count, PCV (Packed Cell Volume), MCV (Mean corpuscular volume), MCHC (Mean corpuscular Haemoglobin Concentration) and RDW (Red cell Distribution Width).

Inclusion Criteria: Newborn babies delivered in Institute of Maternal and Child health, Government Medical College, Kozhikode were included in the study.

Exclusion Criteria: Babies delivered to mothers with documented sepsis, mothers with positive Coomb test, mothers or relatives with hereditary spherocytosis were excluded from the study. Babies with birth asphyxia, hydrops foetalis, and with hepatosplenomegaly were also excluded.

The study was done after obtaining approval from institutional ethics committee. The study group include 70 each of term, term IUGR babies and preterm babies were enrolled in the study.

2ml of blood was collected from the placental end of the umbilical cord in to a bottle containing EDTA. The samples were analysed in fully automated heamatology analyser within 30

minutes. Print out of the report were collected and various data such as Hb, RBC count, PCV, MCV, MCH, MCHC and RDW were obtained. Results were tabulated and analysed. Statistical evaluation was done with SPSS version 16 to find out any significant difference between the three study groups.

Observations & Results

Cord blood was collected from two hundred and ten newborn babies. Seventy each belongs to term (Term Adequate for Gestational Age), term IUGR (Term Small for Gestational Age) and preterm group.

The mean hemoglobin in term, term IUGR and preterm were estimated and compared (Table-1). Results showed that the blood haemoglobin level was higher in term IUGR comparing with term babies and the result obtained was highly statistically significant with p value <0.001. Blood haemoglobin level is was found to be slightly less in preterm babies comparing term babies, but the result obtained was not significant statistically.

Mean RBC count was found to be higher in term IUGR comparing term babies. Similarly mean

RBC count was found to lesser in preterm comparing term babies. The results obtained were statistically significant (Table-2).

Packed cell volume (PCV) also showed statistically significant difference between term, term IUGR and preterm babies- higher in term IUGR and lower preterm comparing term babies (table 3).

Mean corpuscular volume (MCV) was found to be more in prterm babies when compared to term babies, which was statistically significant (Table-4). There was no statistically significant difference in MCV between term and term IUGR babies.

Mean corpuscular hemoglobin (MCH) was found to be higher in preterm and the result obtained was statistically significant (Table-5). Mean corpuscular hemoglobin concentration (MCHC) was found to be higher in preterm than term babies. The difference in MCHC between term and preterm was statistically significant (Table-6). RDW was more in term IUGR babies than term babies, which was statistically significant (Table-7).

Table -1 Cord blood Hamoglobin values in Term, Term IUGR, preterm babies in Northern Kerala

	Term	Term IUGR	Pre term
Mean (gm%)	16.51	18.66	15.93
SD	2.51	2.14	2.71
P value		<0.001	Not significant

SD = standard deviation

Table -2 Cord blood RBC count in term, term IUGR and preterm babies in Northern Kerala

	Term	Term IUGR	Pre term
Mean ($10^5/mm^3$)	4.46	5.02	4.2
SD	0.69	0.63	0.98
P value		<0.001	<0.001

RBC = Red blood cell

Table -3 Cord blood PCV values in term, term IUGR, preterm babies in Northern Kerala

	Term	Term IUGR	Pre term
Mean (%)	48.3	53.7	46.56
SD	6.98	6.1	7.51
P value		<0.001	<0.001

PCV =packed cell volume

Table -4 Cord blood MCV values in term, term IUGR & preterm babies in Northern Kerala

	Term	Term IUGR	Pre term
Mean(fl)	108.09	107.13	111.73
SD	5.62	5.36	8.9
P value		Not significant	<0.001

MCV = Mean corpuscular volume

Table -5 Cord blood MCH values in term, term IUGR & preterm babies in Northern Kerala

	Term	Term IUGR	Pre term
Mean(pg)	37.03	36.76	38
SD	2.35	1.87	3.54
P value		Not significant	<0.001

MCH= Mean corpuscular hemoglobin

Table -6 Cord blood MCHC values in term, term IUGR & preterm babies in Northern Kerala

	Term	Term IUGR	Pre term
Mean(gm/dl)	34.26	34.3	34.03
SD	1.83	1.57	1.49
P value		Not significant	<0.001

MCHC = Mean corpuscular hemoglobin concentration

Table -7 Cord blood RDW values in term, term IUGR & preterm babies in northern kerala

	Term	Term IUGR	Pre term
Mean(%)	18.27	19.63	17.99
SD	2.07	2.38	2.01
P value		0.01	Not significant

RDW= Red cell distribution width

Discussion

Neonatologist constantly face the question, what values found in new born may be considered abnormal regarding haematological parameters, are the haemoglobin and other RBC indices are the same for term, term IUGR and preterm babies, is there is any difference between these groups. These questions are very pertinent because complete blood count determination is frequently done in newborn babies as a part of evaluation of infection, jaundice and pallor. The question is particularly relevant in India because about 30-40% of babies are delivered as LBW (Low birth weight, in contrast the western countries where only 5-7% are delivered as LBW. Another significant difference between the Western countries and India is, 2/3 of the low birth weight babies are term LBW babies in India, which is negligible in Western countries.⁷

The present study has revealed mean hemoglobin values are higher in term IUGR babies and lower in preterm babies. The difference is statistically

significant in term IUGR babies (p value <0.001). Many researchers in the past like Noguera NI et al and D'souza et al observed a significant increase in hemoglobin values in Term IUGR babies.^{8,9} Noguera NI et al observed significant decrease in haemoglobin in preterm babies. Boulot et al also made similar observation about preterm babies.¹⁰

IUGR may be the result of nutritional or oxygen deprivation of foetus. Foetal hypoxia, maternal hypertension, toxemia, malnutrition, chronic illness placental condition like abruption placenta, placenta previa or foetal condition like intrauterine infection, chromosomal anomaly, and multiple gestation may lead to placental insufficiency and IUGR. D'souza et al and Haworth et al observed that increased level of haematocrit and hemoglobin in IUGR babies are due to chronic fetal hypoxia in utero.^{8,11}

RBC count in term, term IUGR and preterm babies were $4.46 \times 10^6/\mu\text{l}$, $5.02 \times 10^6/\mu\text{l}$ and $4.2 \times 10^6/\mu\text{l}$ respectively (table2). From these data it was

revealed that statistically significant increase in RBC count as the gestational age increases. There was further increase in RBC count in term IUGR babies. Several workers in the past like Noguera NI et al and Haworth JC et al had similar observations.^{8,11} PCV also follows a similar trend as RBC count. As the gestational age increases, PCV also increases. Since PCV is a measure of RBC count any condition that increase in RBC count will increase the PCV and vice versa.

Regarding MCV and MCH there was a statistically significant increase in MCV and MCH in preterm above term babies. Boulot et al also made similar observation.⁷ Statistically significant differences were observed in MCHC in term and preterm babies where it was low in preterm. In contradiction to our observation Boulot et al noted relatively constant MCHC throughout the gestation. A detailed study has to be conducted in this population with more sample size to get more accurate results.

Interestingly, mean RDW was found to be more in term babies comparing term IUGR babies, and this result obtained was statistically significant. Probably hypoxia suffered by the fetus may be the cause of this change. Fetal hypoxia stimulates erythropoiesis, leads to influx of immature RBCs into circulation, resulting in anisocytosis. RDW is the coefficient of the variation in cell size and shape.¹²

Conclusion

Mean values of hemoglobin and blood indices of term, term IUGR and preterm babies were derived in Northern Kerala population. There is statistically significant increase in RBC count as the gestational age increases. There is further increase in RBC count in term IUGR babies. MCV and MCH were more in preterm babies when compared term babies. MCHC is more in preterm babies and significant increase in RDW in term IUGR babies. The reference values obtained can be used as background data for proper management of neonatal period.

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