Innovative Journal of Medical and Health Science

IJMHS 9 (5), 424–430 (2019) ISSN (O) 2277:4939 | (P) 2589:9341

COMPARATIVE STUDY OF COMPLETE HAEMOGRAM AND IRON PROFILE FROM CORD BLOOD OF NEW BORN WITH RESPECT TO GESTATION AGE.

Dr.Madhumita Mondal[1], Dr.Ayesha Afreen Islam[2*], Swapan Kumar Sinha[3], S Saha[4]

[1]*Demonstrator, Dept. of Pathology, IPGMER, Kolkata*

[2]*Demonstrator, Dept. of Pathology, IPGMER, Kolkata*

[3]*HOD, Dept. of Pathology, Calcutta Medical College, Kolkata*

[4]*Professor, Dept. of Gynecology and Obstetrics, Calcutta Medical College, Kolkata*

DOI: https://doi.org/10.15520/ijmhs.v9i5.2579
Accepted 15 Apl 2019; Received 3 Apl 2019; Publish Online 27 May 2019

Reviewed By: Dr Daniel V.
Department: Medical

ABSTRACT

Infants and toddlers are vulnerable to the effects of anemia due to rapid growth and development of brain and rest of the body from birth to age three. Preterm and/or low birth weight infants are more vulnerable. Iron-deficiency anemia affects neurological development due to reduced myelination of the spinal cord, as well as a change in myelin composition. To correlate complete hemogram, serum iron, TIBC and serum ferritin of new born of ≤32weeks(wks), 33-36weeks, 37-40weeks and >40weeks gestation age from umbilical cord blood for early detection of anemia and perinatal management of complications.
Ninty six new born cord blood was collected of gestation age ≤ 32wks(10), 33-36wks(12), 37-40wks(60), >40wks(14). Comparison of complete blood count parameters with respect to gestation age was done in a tertiary care hospital, Kolkata by ANOVA(one way analysis of variance) test with Graphpad Instat 3 software.
We found significant correlation coefficient for hematocrit(p=0.024), mean corpuscular volume(p=.0049), platelet count(p=0.0097), red cell distribution width(p=0.033),serum iron(p=0.0034),serumTIBC(p=0.0482). Anemia is often first shown by complete blood count (CBC). Sufficiently low hemoglobin (HGB) by definition makes the diagnosis of anemia, and low hematocrit (HCT) value is also characteristic of anemia. Biochemical tests usually done are serum ferritin, serum iron level, total iron binding capacity (TIBC). Currently, there is no clear recommendation of iron supplementation to the new born with decreased iron content other than exclusive breast feeding which is compulsory to all new born. As it is an easy, early and non-invasive procedure of estimation of fetal iron deficiency, it may be recommended in health care programmes for early detection and treatment of iron deficiency before the development of actual anemia.

Key words: Complete hemogram, gestation age, cord blood.

* Corresponding author.
† Email: annie28dec85@gmail.com.

1. INTRODUCTION

Iron deficiency (ID) is the most common micronutrient deficiency worldwide, with under risk group being pregnant women and children under five years of age. The effect of iron deficiency in toddlers and, particularly, in infants include impaired growth and intellectual development as evidenced by lower than expected IQ scores and shorter stature. Low IQ may become irreversible by the time iron deficiency advances to the anemia level. Iron therapy is began to resolve deficiency[1]. Studies have also demonstrated high frequency of stroke in toddlers with iron deficiency anemia than healthy toddlers[2,3]. Other potential consequences of iron deficiency anaemia can include impaired immunity and temperature regulation, glossitis and other abnormalities of mucosa of mouth and oesophagus and alteration in sleep patterns[4]. There is also a proven association between being iron deficit and increased lead absorption, which exacerbates impairment in cognitive development and makes these children doubly at risk of irreversible neurodevelopment deficit. Preterm infants (<37 wks gestation) are born with smaller stores of iron and grow at a faster rate, and thereby at risk for iron deficiency anaemia at early age of two to three months[5]. Fetal growth velocity is maximum (26.9gm/day) over 32-36wks of pregnancy. It declines gradually to 24gm/day over 36-40wks of gestation. Individual fetal growth varies considerably. Preterm and low birth weight infants have lower haemoglobin values than the full term infants. By age one preterm infants values are generally at normal levels, while low birth weight infants sometimes take longer to reach normal value[5]. Recent studies show that infants with even a transient iron deficiency without anaemia experiences irreversible negative effect to brain; therefore it is important to identify an iron deficiency as early as possible[1]. There is clear evidence that ID during infancy can have long-term adverse effects on cognitive, neurobehavioral and socioemotional development which persists following iron supplementation and resolution of ID. Besides this, there is a continuous relation between birth weight and future risk.

2. MATERIAL AND METHODS

A prospective study was done among newborns delivered per vaginaly in the Department of Gynaecology & Obstetrics, Medical College, Kolkata. Detail clinical history and consent from mother and physical examination were done to note the gestation age and to find the presence of any medical and surgical complications. Gestation age calculation was based on first trimester ultrasound(USG). Cord blood from 96 normal deliveries were collected from placenta of mothers who gave consent, in clotted and EDTA vials. Blood in the EDTA vial was used for complete blood counts and reticulocyte count using auto analyser, peripheral smear were also made. From the clotted blood serum is separated. With the help of semi auto analyser serum iron and TIBC is estimated. Serum ferritin was estimated by ELISA method.

If mothers had haemorrhage in early pregnancy or ante partum haemorrhage, multiple pregnancy, hypertensive disorder in pregnancy, suffering from any debilitating disease like tuberculosis, HIV etc, were excluded from study. Cases without proper clinical history were also not included in this study. For each parameter data are grouped according to gestation age of the new born. Mean, standard deviation, of the data are derived. ANOVA (one way analysis of variance) test with Graph pad In stat 3 software done to reveal any significant correlation. The statistical significance was set at 5 percent ($p<0.05$).

Ethical clearance from institute was taken.

A baby born before 37completed weeks(wks) of gestation calculating from the first day of last menstrual period is arbitrarily defined as preterm baby. Preterm baby constitutes 2/3rd of low birth weight babies. Low birth weight(LBW) infant is defined as one whose birth weight is <2500gm irrespective of gestational age. Very low birth infant weight 1500gm or less.

3. RESULTS

The study was carried out on cord blood of 96 new born babies, delivered within maximum gestation age of 42 wks and minimum of 28 wks. Gestation age of the mother was classified under four groups, ≤32wks, 33-36wks, 37-40wks, >40 wks . The maximum age of mother was 36yrs and minimum was 17yrs of which 14 mothers were <20years age and 10 had age of >30 year. Twenty fife percent(25%) of mothers had haemoglobin(HB) level <10gm% ranging from 6.5%-13% with a mean concentration of 10.66gm%.. Sixty six point seven percent(66.7%) of the newborn were male and 33.3% were females. Sixty two point five percent (62.5%) of deliveries were term (37-40wks), 22.9% of deliveries were preterm(<37wks) and 14.6% of the deliveries were post term(>40wks)(Table.1). HB concentration of the new born babies ranged from13gm% to 19.1gm% with a mean of 15.4gm% and standard deviation(SD) of 1.461. Approximately forty percent (39.6%) of the new born had HB concentration of 14.1 to 15gm %

(Table.2). HB level >16gm% was seen in 10.4% of the newborns (10 cases). None of the newborn had HB level <13gm%. Birth weight of new born ≥ ranged from 1.52kg to 3.6kg with a mean of 2.75kg. Sixty eight percent (68%) babies had birth weight ≥ 2.5kg (Table.3). Comparing the complete blood count parameters with respect to gestation age by ANOVA(one way analysis of variance) test, significant 'p' values for HCT(0.0243),Mean corpuscular volume (MCV)(0.0049), platelet count(0.0097), red cell distribution width(RDW)(.033), serum iron(.0034), serum TIBC(.048)were seen(Table.4). Birth weight of the babies were also compared with serum ferritin(SF) level by ANOVA test, no significant correlation was found (Table.5). Maternal iron parameters are not correlated with newborn iron parameters.

TABLE 1: Table showing distribution of mothers with respect to gestation age at time of delivery:

GESTATION AGE	FREQUENCY	PERCENT
≤32 WKS	10	10.4
33-36WKS	12	12.5
37-40 WKS	60	62.5
>40WKS	14	14.6
TOTAL	96	100

TABLE 2: Table showing distribution of HB of new born babies:

Hb concentration	Frequency	PERCENT
13-14mg/dl	34	35.4
14.1-15mg/dl	38	39.6
15.1-16mg/dl	14	14.6
>16mg/dl	10	10.4
Total	96	100

TABLE 3: Table showing distribution of Birth weight of new born babies:

Birth weight	Frequency	Percent
<1800gm	04	4.2
1800-2499gm	24	25
≥2500gm	68	70.8
Total	96	100

TABLE 4: Table showing comparison of gestation age with respect to different parameters:

PARAMETERS	GESTATION AGE				P value
	≤32WKS (M±SD)	33-36WKS (M±SD)	37-40WKS (M±SD)	>40WKS (M±SD)	
T count	4.38±0.205	4.47±0.403	4.64±0.476	4.39±0.393	0.1057
HB	14.38±1.44	15.56±1.014	15.45±1.449	15.74±1.67	0.116
HCT	40.08±7.29	48.70±3.57	46.12±6.38	46.08±8.129	0.0243
MCV	91.48±12.84	106.73±5.623	101.75±9.265	98.2±14.503	0.0049
MCH	32.7±2.689	34.18±2,688	34.32±1.971	33.08±2.958	0.0915
MCHC	36.6±7.27	31.98±1.15	33.89±3.728	33.82±4.854	0.0912
NRBC	6.20±1.39	5.5±1.78	5.6±1.36	4.85±1.46	0.151
PLT Count	1.93±0.65	2.12±0.847	2.28±0.63	1.63±0.55	0.0097
TLC	14.84±4.57	10.75±3.44	15.44±6.416	13.42±2.447	0.0564
Retic count	4.04±0.70	4.76±0.65	4.54±0.92	4.41±0.69	0.2238
RDW	19.44±2.42	18.46±1.087	18.57±1.57	17.34±1.023	0.033
SER. Iron	166.6±68.85	119.67±26.304	122.78±28.93	119.83±30.533	0.0034
TIBC	400.06±63.4	373.5±66.8	393.21±53.98	350.73±34.82	0.0482
Ferritin	85.97±75.94	110.35±106.95	139.33±120.63	118.36±188.46	0.6033

TABLE 5: Table showing comparison of birth weight of new born babies with respect to ferritin:

Birth weight	Ferritin (mean±SD)	P value
<1800gm	127.46±128.47	
1800-2499gm	159.44±140.64	0.351
≥2500gm	115.64±121.55	

4. DISCUSSION

Different blood profiles of 96 newborn with their mothers were compared with different previous similar studies. Cord blood mean HB of newborn of ≤32weeks was 14.38±1.44gm% and 33-36 weeks was 15.56±1.014gm%, 37-40 weeks was 15.45±1.44 gm% and >40weeks was 15.67±1.74gm%. No statistical significant value was found (p=0.116). Mean HB of 96 new born are 15.4±1.46.

The mean cord blood HCT of 96 new born was 45.81±6.88 and ranged from 29 to58.7%. HCT of the babies born at gestation age of ≤32 wks was 40.08±7.29%, 33-36wks was 48.7±3.57%, 37-40wks was 46.12±6.38% and >40wks was 46.08±8.129%. Statistically significant relation (p=0.0243) was established.

In the present study the mean RBC count (n=96) was 4.56±0.447million/cumm. The total count of the new born of ≤32wks was 4.38±0.205million/cumm, 33-36wks was 4.47±0.403million/cumm, 37-40wks was 4.68±0.476million/cumm & of >40wks was 4.39±0.393million/cumm. No statistically significant p value was obtained.

Mean MCV of 96 cases was 100.78fl±10.79. MCV of the new born of ≤32wks(n=10) was 91.48±12.84fl, 33-36wks(n=12) was 106.73±5.62fl, 37-40wks was 101.75±9.26fl & >40wks(n=14) was 98.2±14.50fl. Statistically significant p value (p=0.0049) was obtained.

The mean MCH was 33.95±2.34pg & MCHC was 33.92±4.7gm/dl. In newborn of ≤32wks the MCV & MCHC was 32.7±2.68pg & 36.6±7.27gm/dl respectively. In cases of 33-36wks MCH & MCHC was 34.18±2.688pg & 31.98±1.15gm/dl respectively. In cases of age 37-40wks the MCH & MCHC was 34.32±1.97pg & 33.89±3.72gm/dl respectively. In cases of age >40wks the MCH & MCHC was 33.08±2.95pg & 33.82±4.85gm/dl respectively. The values showed weak correlation (p=0.091for both).

Mean platelet count in this present study was 2.13±0.68akh/cumm. Platelet count of newborn of ≤32wks was 1.93±0.65lakh/cumm, 33-36wks was 2.12±0.84lakh/cumm, 37-40 wks was 2.28±0.63lakh/cumm & >40wks was 1.63±0.55lakh/cumm. Significant correlation was obtained (p=0.0097). SandhyaSivakumara et al found a value of 1.53 lakh/cumm as mean platelet count in preterm babies.[6] Sandhya Sivakumara had found the mean cord blood platelet count in cases of babies born to mothers with pregnancy induced hypertension, 1.941akh/cu.mm, which was sufficiently lower than control group.[6]

In the present study mean nRBC count was 5.54±1.45%. Mean nRBC in the newborns of ≤32wks was 6.2±1.39%, 33-36wks was 5.5±1.78%, 37-40wks was 5.6±1.36% &>40wks was 4.85±1.46%(p= 0.1).

Mean reticulocyte count was 4.5±0.85%. Reticulocytes count of newborns of ≤ 32wks was 4.04±0.70%, 33-36wks was 4.76±0.65%, 37-40wks was 4.54±0.92% &>40wks was 4.41±0.69%. No significant positive correlation was found(p=0.22).

The total leukocyte count in cord blood was determined in 96 cases. Mean was 14.49±5.66thousand/cumm. Total leukocyte count of the newborn of ≤32wks age was 14.84±4.57thousand/cumm, 33-36wks was 10.75±3.44thousand/cumm, 37-40wks was 15.4±6.41thousand/cumm, >40wks was 13.42±2.44thousand/cumm. We found week positive correlation (p=0.056).

Serum iron was determined in all newborns (1.26±36.93 µg/dl). Serum iron of the newborns of ≤32 wks was 166.6±68.8µg/dl, 33-36wks was 119.67±26.3µg/dl, 37-40wks was 122.78±28.9µg/dl, >40 wks was

119.83±30.5µg/dl. The p value was 0.0034. K.E. Elizabeth et. al. found iron were significantly lower in low birth weight(LBW) babies compared to term control babies. The values were lowest in preterm LBW followed by term LBW.[7] Serum TIBC was measured in all the newborns (385.26±55.94µg/dl). Serum TIBC of new born of ≤32wks was 400±63.4µg/dl, 33-36wks was 373.5±66.8µg/dl, 37-40wks was 393.21±53.98µg/dl, >40wks was 350.73±34.82µg/dl. Significant correlation coefficient (p=0.048) was found. SF concentration is well established indicator of ID in older children and adults.[8] More recent works shows that cord SF concentration is appropriate indicator of ID in neonates.[9,10] Our work showed SF of newborns of ≤32wks was 85.97±75.94ng/ml, 33-36wks was 110.35±106.95ng/ml, 37-40 wks was 139.33±120.63 ng/ml, >40wks was 118.36±188.46 ng/ml. Statistically significant correlation was not found(p=0.6)

5. CONCLUSION

Gestation age had positive correlation with some parameters of complete hemogram(HCT, MCV, PLT, RDW) and iron profile(serum iron, TIBC) which might help us to diagnose neonates of increased risk of developing ID in future. This easy practice might be incorporated in new health care programs.

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AUTHOR BIOGRAPHY

Dr. Madhumita Mondal, Demonstrator, Dept. of Pathology, IPGMER, Kolkata
Dr. Ayesha Afreen Islam, Demonstrator, Dept. of Pathology, IPGMER, Kolkata
Swapan Kumar Sinha, HOD, Dept. of Pathology, Calcutta Medical College,Kolkata.
S Saha, Professor, Dept. of Gynecology and Obstetrics, Calcutta Medical College, Kolkata.