

Effects of maternal hemoglobin on fetal birth weight

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Abstract

Introduction: Anaemia is one of the main nutritional deficiency disorders affecting a large proportion of the population, not only in developing but also in industrialized countries. The high prevalence of iron and other micronutrient deficiencies among women before and during pregnancy in developing countries is of concern and maternal anaemia is still a cause of considerable perinatal mortality and morbidity. The improvement in the industrialized world is due largely to more effective diagnosis and treatment of anaemia. **Aim of the study:** To determine effect of maternal hemoglobin on fetal cord blood haemoglobin and birth weight, To find out relation between cord blood haemoglobin and maternal haemoglobin & to find the relation of birth weight to maternal haemoglobin. **Results:** The prevalence of low birth weight among anemic mothers was 24%. Total number of babies with cord blood hemoglobin < 16.8 gms% in mild anemic mothers were 74 (80.4%) moderate anemia were 43 (79.6%) and in severely anemic mothers were 2 (50%). The demographic data of patients were studied for the 3 groups (mild, moderate, severe according to WHO classification of anemia) The means of the continuous variables were compared between the two groups using analysis of variance ANOVA. The P value of < 0.05 was considered statistically significant. **Conclusion:** In babies born to anemic mothers cord blood hemoglobin is low. Severity of maternal anemia is determinant of low birth weight. The proportion of low birth weight in babies born to severe anemic mothers were more when compared to mild and moderate anemia

Key words: Anemia, Birth weight, Haemoglobin, Cord blood

Introduction

Anaemia is one of the main nutritional deficiency disorders affecting a large proportion of the population, not only in developing but also in industrialized countries. In the developing countries, poverty, gender bias and lack of education about the importance of a balanced and iron-rich diet contribute to anaemia. The high prevalence of iron and other micronutrient deficiencies among women before and during pregnancy in developing countries is of concern and maternal anaemia is still a cause of considerable perinatal mortality and morbidity. The improvement in the industrialized world is due largely to more effective diagnosis and treatment of anaemia. According to WHO anemia is present when the hemoglobin percentage is less than 11 gm per dl during pregnancy [1].

Anemia is classified into moderate, severe & very severe as shown in the table below: Most common cause of anemia during pregnancy is iron deficiency. In addition to iron deficiency other causes of anemia are megaloblastic anemia, anemia caused by acute blood loss, anemia of inflammation or malignancy, acquired hemolytic anaemia, aplastic/ hypo plastic anemia and other hereditary causes like thalassemias, hemoglobinopathies, and hereditary hemolytic anaemia [2].

The modest fall in hemoglobin levels observed during pregnancy in healthy women not deficient in iron or folate is caused by a relatively greater expansion of plasma volume compared with the increase in hemoglobin mass and red cell volume. The disproportion between the rates at which plasma and erythrocytes are added to the maternal circulation is

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normally greatest during the second trimester. The resulting hemodilution results in physiological anemia of pregnancy [2]. During the puerperium, in the absence of excessive blood loss, hemoglobin concentration is not appreciably less than pre delivery. After the delivery the hemoglobin level fluctuates around the pre delivery value for a few days and then rises to the higher non pregnant level. The rate and magnitude of increase early in the puerperium is the result of the amount of hemoglobin added during pregnancy and the amount lost by blood loss at delivery and modified by a puerperal decrease in plasma volume. Effects of anemia in the baby are low birth weight and intrauterine growth retardation (this occurs because maternal anemia influences placental vascularisation by altering angiogenesis during early pregnancy) [3]. Effects of anemia on mother are preeclampsia and eclampsia, abruptio placenta, preterm labor, premature rupture of membranes, precipitate labor, post partum hemorrhage, cardiac failure in severe anemia, puerperal infection, deep vein thrombosis, and failure of lactation.

Category (Anemia severity)	Hemoglobin Level (gm/dl)
Mild	10-10.9
Moderate	7.1-9.9
Severe	4.1-7.0
Very severe	< 4.0

- This study was undertaken to determine the effect of maternal hemoglobin on fetal cord blood haemoglobin and birth weight

Material and Methods

The Study was conducted with collaboration of Departments of Pediatrics and Obstetrics/Gynecology at MediCiti Institute of Medical Sciences (MIMS) from December 2011 to June 2013. Institutional Ethical committee approval was sought. An informed consent was obtained from all mothers willing to participate in the study.

Sample size - 150

Venous blood samples from the mother were taken at the time of delivery along with cord blood Hemoglobin from the blood samples were estimated by Cyanmeth Hemoglobin Method. Newborn weight was recorded by digital scale (corrected upto 10 g). Gestational age assessment was done by New Ballards score in Departments of Pediatrics and Obstetrics/Gynecology, MIMS [4].

Inclusion criteria – all term babies born in this hospital with maternal hemoglobin < 11 g/dl

Exclusion criteria – Babies born to women having medical conditions known to influence fetal growth –

- Hypertensive disorder of pregnancy
- Cardiac failure, -Acute systemic infections or chronic infections
- Multiple pregnancy -Metabolic disorders like diabetes mellitus
- New borns with congenital anomalies
- Babies born outside the hospital
- Mothers with hemoglobin \geq 11 g/dl.

Results

Total number of deliveries (normal and Caesarean section) during the period from December 2011 to June 2013 were 3210. After fulfilling inclusion and exclusion criteria 150 normal term babies with maternal hemoglobin < 11gms % were included in the study.

Statistical Analysis- The demographic data of patients were studied for the 3 groups (mild, moderate, and severe according to WHO classification of anemia)

Statistical analysis was done using STATA 11 software. Data was expressed as either mean \pm standard deviation or numbers and percentages. The means of the continuous variables were compared between the two groups using analysis of variance ANOVA. The P value of < 0.05 was considered statistically significant.

Out of 150 babies, 36 (24%) babies were of low birth weight and 114 (76%) normal weight (≥ 2.5 kg). Out of 150 mothers, 92 (61.32%) had mild anemia and 54 (36%) moderate anemia and 4 (2.67%) had severe anemia.

Table-1: Frequency Distribution of babies according to cord blood hemoglobin

Cord blood Hb in gm%	No. Of babies N=(150)	%
≥ 16.8	31	20.67
< 16.8	119	79.33

- Low birth weight babies in mothers with mild anemia were 17 (18.5%), moderate anemia 16(29.7%) and those with severe anemia are 3(75%)
- Total number of babies with cord blood hemoglobin < 16.8 gms% in mild anemic mothers were 74 (80.4%) , moderate anemia were 43(79.6%) and in severely anemic mothers were 2 (50%).

Table-2: Categorical Distribution of cord blood hemoglobin according to birth weight (N=150)

Birth Weight	Cord Hb (gms%) ≥ 16.8 (n=31)	Cord Hb (gms%) < 16.8 (n=119)
≥ 2.5	23(74%)	91(76.4%)
< 2.5	8(25.80%)	28(23.5%)

Table-3: Assessment of Birth Weight according to maternal hemoglobin

Groups	Birth Weight	
	Range	Mean \pm SD
Maternal Hemoglobin 10-10.9 gms% (MILD)	2.02 - 4.4	2.844 \pm .428
Maternal Hemoglobin 7.1-9.9 gms%(MODERATE)	1.6 - 3.8	2.670 \pm .453
Maternal Hemoglobin 4.1-7.0 gms%(SEVERE)	1.6- 3.12	2.227 \pm .639
Significance	F =6.70, p=0.0044 (significant)	

Table-4: Assessment of Cord Blood Hemoglobin according to maternal Anemia

Groups	Cord Blood Hemoglobin	
	Range	Mean \pm SD
Maternal Hemoglobin 10-10.9 gms%(MILD)	7.6 - 19.5	14.60 \pm 2.620
Maternal Hemoglobin 7.1-9.9 gms%(MODERATE)	8.3 - 19.8	14.753 \pm 2.510
Maternal Hemoglobin 4.1-7.0 gms%(SEVERE)	13.7 - 18.5	16.025 \pm 2.334
Significance	F = 0.61, p= 0.545 (Not significant)	

The proportion of low birth weight of babies born to mothers with severe anemia is significantly more when compared to babies born to mothers with mild anemia.

Discussion

Prevalence of anaemia in all the age groups is higher in India as compared to other developing countries. According to WHO, the prevalence of anaemia in pregnancy in globally is around 55.9%. In India incidence of anaemia in pregnancy has been noted as high as 33-89% [5]. It increases the maternal morbidity,

fetal and neonatal mortality and morbidity significantly with 7-10 million children born with low birth weight each year. Margaret Balfour was credited as the first to draw the attention of anaemia in pregnancy in India [6]. Levy et al for example, observed that maternal anemia was an independent risk factor for preterm delivery and

low birth weight [7]. Malhotra et al, observed that the mean birth weight was highest in babies with maternal haemoglobin concentration between 9.6 and 10.5 gm % [8].

This study examined the relationship between maternal anemia and cord blood haemoglobin and the influence of maternal anemia on birth weight.

The values of cord blood hemoglobin were lower than the normal cord blood hemoglobin values in all grades of severity of maternal anemia, however there was no significant change in cord blood hemoglobin with increasing severity of maternal anemia.

In our study there was positive relationship between severity of maternal anemia and low birth weight. The proportion of birth weight in newborn of mothers with severe anemia was significantly low when compared to newborns of mothers with mild and moderate anemia.

3 of 4 (75%) babies born to mothers with severe anemia were low birth weight (< 2.5 kg). 16 of 54 (29%) babies born to mothers with moderate anemia are low birth weight. 17 of 92 (18.4%) babies born to mothers with mild anemia were low birth weight.

Maternal hematological status and risk of low birth weight and preterm delivery was studied in Patan Hospital, Kathmandu, Nepal. In this case-control study, 1400 pregnant women who attended the hospital for antenatal care and delivery in the period 1994 to 1996 were included. Severe anemia (hematocrit \leq 24%) was associated with a significantly increased risk of low birth weight (<2500 g) and preterm delivery (<37 weeks gestation) [9].

In study of Nadia et al the newborn birth weight was affected by maternal anaemia: out of 50 newborns 35 babies born to mothers with mild anemia had mean birth weight of 3.1 Kg, 11 babies born to mothers with moderate anemia had mean birth weight of 2.7 kg and 4 babies born to mother with severe anemia the mean birth weight was 2.2 kg [10]. Hence in our study the relation of severity of maternal anemia with birth weight was similar to Nadia et al study.

The effect of maternal iron deficiency anemia on fetal growth was studied by Singla et al in 54 anaemic (haemoglobin < 11.0 g/dl) mothers. Twenty-two mothers served as controls (haemoglobin \geq 11.0 g/dl). [11]

The birth weight, head circumference, chest circumference, mid-arm circumference, and crown heel length were significantly low in infants born to women with moderate (haemoglobin 6.1 to 8.5g/dl) and severe anaemia (haemoglobin \leq 6.0 g/dl), in comparison to infants born to non-anaemic women. In our study where only newborn weight was taken into account mothers with severe anemia have significantly lower birth weight babies.

Low birth weight in severely anemic mothers can be explained due increased levels of stress hormones, nor epinephrine, and cortisol.

Conclusion

1. In babies born to anemic mothers cord blood hemoglobin is low.
2. Severity of maternal anemia is determinant of low birth weight.

The proportion of low birth weight in babies born to severe anemic mothers were more when compared to mild and moderate anemia

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Permission from IRB: Yes

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