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Research Article

CLINICAL CORRELATION OF MATERNAL AND CORD HAEMOGLOBIN

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ABSTRACT

Background: Maternal anemia has several deleterious effects on the health of the mother and fetus. This study was conducted to assess the effect of maternal anemia on cord blood hemoglobin and birth weight of the neonate.

Aims and Objectives: To correlate maternal anemia with cord blood hemoglobin and to evaluate the birth weight of neonates.

Methodology: A prospective hospital based study was conducted with 200 pregnant anemic female patients and their cord blood in D.Y Patel hospital, Neural in a period of 18 months.

Results: It was observed that out of 200 pregnant females included in the study, 110 (55%) patients were mildly anemic while 80 (40%) and 10 (5%) patients were moderately and severely anemic respectively. The overall incidence of neonatal anemia was 19.5% in this study. It was found that 6 neonates born to severely anemic mothers, 18 neonates born to mothers with mild anemia and 15 neonates born to mothers with moderate anemia had anemia. This showed a significant association of maternal and cord hemoglobin.

The incidence of Low birth weight neonates was 32% in this study, demonstrating a significant association of low birth weight with maternal anemia. It was observed that 54.7% of neonates had low birth weight born to mothers with moderate anemia while 6.3% and 35.7% neonates in the low birth weight category were of mothers with severe and mild anemia respectively.

Conclusion: Maternal anemia affects both hemoglobin and birth weight of neonates. The present study found a linear relationship between maternal hemoglobin, cord blood hemoglobin with birth weight.

INTRODUCTION

The growth of the fetus can be regarded as a result of the interaction between its genetic potential and the intrauterine environment. Mothers who enter pregnancy in good health, With sound reproductive physiology and who have not suffered chronic illness or nutritional deprivation in childhood will have larger and healthier infants than mothers who do not have such advantages?

Anaemia is often asymptomatic in pregnancy, with the diagnosis being made on routine screening. 1India has reported highest prevalence of anaemia in pregnancy. A high proportion of women in both industrialized and developing countries become anaemic during pregnancy. 2 Anaemia, defined by World Health Organization (WHO) as haemoglobin levels of ≤ 11g/dl, is one of the world's leading causes of disability. The prevalence of anaemia in pregnant women is 14% in developed and 51% in developing countries and 65-75% in India as estimated by WHO. Neonates of anaemic mothers are more prone to adverseperinatal outcome like preterm and small for gestational age (SGA) births, low birth weight (LBW) births, intra uterine growth restriction (IUGR) and increased perinatal Mortality rates.

The following categories have been defined by the World Health Organization

***Low birth weight*:** <2500 g

Very low birth weight (VLBW) – less than 1,500g
Extremely low birth weight (ELBW) – Less than 1,000 g
A significant increase in low birth weight has been reported when maternal haemoglobin Levels were below 8.0 g/dl. Preterm and or low birth weight babies (PT/LBW) are associated

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with higher risk for mortality in the first year of life, with developmental problems in childhood, and with risk of several diseases in adulthood. More than 60% of the mortality that occurs among infants without anatomic or chromosomal congenital defects is attributable to low birth weight (LBW).3 Birth weight is the single most important marker of adverse perinatal, neonatal and infantile mortality and infant and childhood morbidity.4 WHO has estimated 5 million neonatal deaths globally occur every year. According to WHO 2010 in India 55-60 % of infant death occurs in neonatal period. Over 80% of all neonatal deaths in both the developed and developing countries occur among the low birth weight babies. Cord blood haemoglobin is an important index of hematologic status in newborns at birth and gives a clue to the state of health of both pregnant mothers and their newborns.

It is also routinely been used in diagnosis of neonatal anaemia and polycythemia. Haemoglobin increases with advancing gestational age: at term, cord blood haemoglobin is 16.8 g/dL (14-20 g/dL); haemoglobin levels in very low birth weight (VLBW) infants are 1-2 g/dL below those in term infants. A haemoglobin value less than the normal range of haemoglobin for birth weight and postnatal age is defined as anaemia.5 Hence the present study was done at a tertiary care hospital with a purpose to correlate Maternal anaemia with cord haemoglobin and its effect on the newborn baby through the Study of cord blood haemoglobin level and their correlation with birth weight.

MATERIAL AND METHODS

A hospital based prospective study was conducted with 200 pregnant anaemic females to correlate maternal anaemia with cord haemoglobin and its effect on the birth weight of the neonate.

This study was done using survey system methodology.

Inclusion Criteria

History and blood investigation of 200 pregnant anaemic female patients of age group of 18-35 years of age and their cord blood were taken.

Exclusion Criteria

1. Age less than 18 years and more than 35 years
2. Medical illness like diabetes/thyroid/renal or heart disease
3. TORCH infection or malaria during antenatal period
4. Babies with congenital anomalies, syndrome complexes
5. women with history of smoking, tobacco use, alcoholics or narcotic drug intake
6. Pregnancy induced hypertension or eclampsia.

METHODOLOGY

Detailed history, clinical examination, management and outcome as per the case record form (CRF) were noted. Venous samples were taken from the pregnant mothers for assessing the haemoglobin level. Anaemia in mother were classified according to their haemoglobin levels into mild, moderate and severe as per ICMR classification.

Table 1 ICMR (The Indian Council of Medical Research) categories of Anaemia7

Category	Anaemia severity	Hb levels (gm/dl)
1	Mild	10-10.9
2	Moderate	7-10
3	Severe	<7
4	De-compensated	<4

After delivery of the baby blood sample were collected in an EDTA bottle from a 15-20 cm length of the umbilical cord incised while severing it at the time of birth of the baby and blood sent for Haemoglobin analysis. After birth, weight of the newborns was recorded.

Haemoglobin measurements

Maternal haemoglobin sampling was done under aseptic precautions, peripheral venipuncture blood samples of 2ml were collected in EDTA sample bottle from the pregnant women for the determination of Hb levels before delivery. Accordingly, 2 ml of cord blood was collected immediately in EDTA sample bottle after delivery of the baby for measuring neonate's cord blood haemoglobin levels. Haemoglobin was estimated using automated cell counter method using BECKMAN Automated haematology analyzer.Anaemia in mother was considered as haemoglobin concentration of <11gm/dl. In neonates anaemia was considered as cord blood haemoglobin of <14gm/dl.

Birth weight

For measuring birth weight electronic scales which provide reasonably valid and precise readings were used. Birth weight was recorded in Kilograms. Babies were weighed naked immediately after birth. A transfer paper placed on the scale and the newborn weighed as quickly as possible never leaving unattended and the scale cleaned between uses. Babies weighed in a weighing machine on lever actuated weighing scales to the nearest 50g.

The following was noted in all neonates included in the study

1. Detailed maternal history like age, parity, gestational age
2. Details of labour, mode of delivery, presence of complications if any during labour
3. Details of baby like: sex, date of birth, time of birth
4. Cord blood sample was collected at birth from the neonates and sent for haemoglobin estimation.
5. All investigations were done at the clinical pathology and haematology laboratory at a tertiary care hospital.

Quantitative data was presented with the help of Mean and Standard deviation. Comparison among the study group was done with the help of unpaired't' test as per results of normalcy test. Qualitative data was presented with the help of frequency and percentage table. Association among the study groups is assessed with the help of Fisher's test, Student't' test and Chi square test. 'p' value less than 0.05 is taken significant. Appropriate statistical software, including but not restricted to MS-Excel. SPSS version 20 was used for statistical analysis. Graphical representation was done in MS-Excel 2010.

OBSERVATIONS AND RESULTS

A hospital based prospective study was conducted with 200 pregnant anaemic patients tocorrelate maternal anaemia with cord haemoglobin and its effect on the newborn baby and their weight.

Distribution of patients according to Maternal Age

Majority of the patients (56%) were in the age group of 21-25 years followed by 21.5% in the age group of 26-30 years, 19.5% in the age group of 18-20 years and 3% in the age group of 31-35 years. The mean age of the patients was 22.9± 3.53 years.

Table 2 Distribution of patients according to Maternal Age

Age (yrs)	N	%
18-20	39	19.5%
21-25	112	56%
26-30	43	21.5%
31-35	6	3%
Total	200	100%
Mean age	22.9± 3.53	

Distribution of patients according to Haemoglobin Levels

110 (55%) patients were mildly anaemic while 80 (40%) and 10 (5%) patients were moderately and severely anaemic respectively.

Table 3 Distribution of patients according to Haemoglobin Levels

Anemia Severity	Hb Levels	N	%
Mild	10-10.9	110	55%
Moderate	7-9.9	80	40%
Severe	4-6.9	10	5%
Very Severe	<4	0	-
Total		200	100%

Birth Weight of Neonates

68% of neonates were of normal birth weight and incidence of low birth weight was 64 (32%) of which extremely low birth weight neonates constituted 4 (2%), very low birth weight were 5 (2.5%) and low birth weight were 55 (27.5%). The mean birth weight ofneonates was 2.67±0.53 kgs.

Table 4 Birth Weight of Neonates

Birth Weight (kgs)	N	%
ELBW (<1 kg)	4	2%
VLBW (1-1.5 kgs)	5	2.5%
LBW (1.6-2.5 kgs)	55	27.5%
Normal BW (>2.5 kgs)	136	68%
Total	200	100%
Mean±SD	2.67±0.53	

Association of Birth Weight and Maternal Haemoglobin

There were 64 (32%) low birth weight neonates. 25 (39%), 35 (54.7%) and 4 (6.3%) neonates were born to mothers with mild, moderate and severe anaemia respectively. There was significant association of birth weight and maternal haemoglobin (**p<0.05**).

Table 5 Association of Birth Weight and Maternal Haemoglobin

Birth Weight (kgs)	Mild		Moderate		Severe		Total
	N	%	N	%	N	%	
ELBW (<1 kg)	2	1%	2	1%	0	-	4
VLBW (1-1.5 kgs)	1	0.5%	4	2%	0	-	5
LBW (1.6-2.5 kgs)	22	11%	29	14.5%	4	2%	55
Normal BW (>2.5 kgs)	85	42.5%	45	22.5%	6	3%	136
Total	110	55%	80	40%	10	5%	200

Chi-Square	df	p Value
13.976	1	<0.05

Association of Maternal Haemoglobin and Cord Haemoglobin

It was observed that overall incidence of neonatal anaemia was 19.5%. In severely anaemic mothers 6 (3%) neonates were anaemic whereas 15 (7.5%) neonates were anaemic in moderately anaemic mothers and 18 (9%) neonates were anaemic in mildly anaemic mothers. There was significant association of maternal haemoglobin and cordhaemoglobin **(p<0.05).**

Table 6 Association of Maternal Haemoglobin and Cord Haemoglobin

Cord Haemoglobin	Mild		Moderate		Severe		Total
	N	%	N	%	N	%	
<14 (anaemic)	18	9%	15	7.5%	6	3%	39
>14 (non anaemic)	92	46%	65	32.5%	4	2%	161
Total	110	55%	80	40%	10	5%	200

Chi-Square	df	p Value
11.167	1	<0.05

Association of Birth Weight and Cord Haemoglobin

In anaemic neonates 56.4% and 30.8% were LBW and normal birth weight respectively. There was significant association of birth weight and cord haemoglobin **(p<0.05).**

Table 7 Association of Birth Weight and Cord Haemoglobin

Birth Weight (kgs)	<14 (anaemic)		>14 (non anaemic)		Total
	N	%	N	%	
ELBW (<1 kg)	2	1%	2	1%	4
VLBW (1-1.5 kgs)	3	1.5%	2	1%	5
LBW (1.6-2.5 kgs)	22	11%	33	16.5%	55
Normal BW (>2.5 kgs)	12	6%	124	62%	136
Total	39	19.5%	161	80.5%	200

Chi-Square	df	p Value
32.195	1	<0.05

Correlation of Different Parameters

Pearson's correlation test showed that the neonatal parameters (cord haemoglobin and birth weight) were significantly linearly correlated with maternal haemoglobin status **(p<0.05).**

Table 8 Correlation of Different Parameters

Correlation	Correlation coefficient (r)	p Value
Maternal Hb vs. Cord Hb	0.422	<0.05
Maternal Hb vs. Birth Weight	0.202	<0.05

DISCUSSION

A hospital based prospective study was conducted with 200 pregnant anaemic patients to correlate maternal anaemia with cord haemoglobin and its effect on the newborn baby and their birth weight. Maternal haematological status plays an important role on her health and that of the foetus. Najeeba CM *et al* 6 in a prospective study observed the effects of maternal anaemia on the newborn by assessing the cord blood haemoglobin level and the birth weight was taken. The authors found that there are no linear correlation between maternal and cord haemoglobin except in reduction in haemoglobin values in severe maternal anaemia at birth thus leading to the conclusion that the foetus continues to extract iron efficiently from the mother regardless of her iron status. The similar results noted by Klibride J *et al* 7 and Erdem A *et al*.8 Sweet DG *et al* 9 in a study on maternal influences on foetal iron status found that maternal iron depletion is associated with reduced foetal iron stores but no change in free iron availability by assessing the serum transferrin receptors. In the present study, majority of the patients (56%) were in the age group of 21-25 years followed by 21.5% in the age group of 26-30 years, 19.5% in the age group of 18-20 years and 3% in the age group of 31-35 years. The mean age of the patients was 22.9± 3.53 years. 68% of neonates were of normal birth weight and incidence of low birth weight was 64 (32%) of which extremely low birth weight neonates constituted 4 (2%), very low birth weight were 5 (2.5%) and low birth weight were 55 (27.5%). The mean birth weight of neonates was 2.67±0.53 kgs.

There were 64 (32%) low birth weight neonates. 25 (39%), 35 (54.7%) and 4 (6.3%) neonates were born to mothers with mild, moderate and severe anaemia respectively. There was significant association of birth weight and maternal haemoglobin (p<0.05).

It was observed that overall incidence of neonatal anaemia was 19.5%. In severely anaemic mothers 6 (3%) neonates were anaemic whereas 15 (7.5%) and 18(9%) neonates were anaemic in moderately and mildly anaemic mothers respectively. There was significant association of maternal haemoglobin and cord haemoglobin (p<0.05).

It was observed in our study that in anaemic neonates, 56.4% and 30.8% were LBW and normal birth weight respectively. There was significant association of birth weight and cord haemoglobin (p<0.05).

Pearson's correlation test showed that the neonatal parameters (cord haemoglobin and birth weight) were significantly linearly correlated with maternal haemoglobin status (p<0.05).

CONCLUSION

Maternal anaemia affects both haemoglobin and birth weight of neonates. The present study found a linear relationship between maternal haemoglobin, cord blood haemoglobin and birth weight of the newborns. Maternal anaemia is a common and important complication of pregnancy that can be detected by simple and low cost screening test. Maternal and foetal complications of anaemia can be prevented by adequate measures and prophylaxis during pregnancy. Further studies are needed to determine the relation of maternal iron to the foetal iron and ferritin levels.

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