



ORIGINAL RESEARCH PAPER

Paediatric Medicine

STUDY OF HEMOGLOBIN AND IRON STATUS OF NEWBORN IN CORRELATION WITH HEMOGLOBIN AND IRON STATUS OF MOTHER

KEY WORDS: Hemoglobin, Iron, Ferritin

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ABSTRACT

Background: Even though the fetus functions like a parasite in situations like iron-deficiency, it also suffers from the adverse effects of maternal iron-deficiency.

The risk of premature delivery is increased to two to four times, when the maternal hemoglobin level falls from 10g/dl to 8g/dl. Anemia is associated with restriction of growth in the fetus, that may lead to adult cardiovascular diseases.

A U-shaped relationship is obtained between the maternal hemoglobin levels and the maturity and the birth weight of the babies i.e. anemia reduces the oxygen-carrying capacity of the blood which leads to poor placental oxygenation. Effects of maternal anemia on iron stores of the fetus are variable. Usually the fetus extracts the iron required for it from the mother. But when the mother herself is depleted of iron stores, the fetus doesn't get adequate iron stores and the neonate is at increased risk of anemia in infancy.

Materials And Methods: This is a prospective study carried out in civil hospital ahmedabad during time period of January 2020 to December 2020 in which 60 pregnant females of either primi or second gravid are included in study and their hemoglobin and iron status is correlated with the hemoglobin and iron status of their newborn.

Results And Conclusion: The study shows a positive correlation exists between the maternal and the neonatal hemoglobin levels. Even though the hemoglobin values of the babies falls in the normal range but their values are low compared to neonates of non anaemic mothers. The serum iron and serum ferritin values of the neonates correlate with the maternal hemoglobin levels and serum ferritin are very low in the neonates of the mothers with severe iron-deficiency.

INTRODUCTION

The mean cord blood hemoglobin of healthy term infant ranges from 15.7 to 17.9 g/dl with a mean of 16.8 g/dl. Shortly after birth hemoglobin concentration rises. This rise is absolute as well as relative—absolute owing to placental RBC transfusion and relative owing to the reduction of plasma volume.

Neonatal anemia is defined as hemoglobin or hematocrit concentration of >2 standard deviation below the Mean for postnatal age. Rapid changes in normal hematological parameters take place throughout the neonatal period. Therefore, the diagnosis of anemia in the newborn is made in relation to gestation and postnatal age. Anemia during 1st week of life is defined as hemoglobin level less than 14 g/dl. The mean cord blood hemoglobin of healthy term infant ranges from 15.7 to 17.9 g/dl with a mean of 16.8 g/dl.

During neonatal period, RBC values are more variable than any other time of life and understanding of normal values of hemoglobin and other red cell indices is essential for diagnosing anemia in newborn.

Maternal Changes In RBC Indices During Pregnancy

The red blood cell (RBC) mass increases by 30%, whereas the plasma volume increases by 40% to 50%, resulting in erythrocyte dilution by 5% to 15% and a decrease in hemoglobin concentration by approximately 2g/dl. The peripheral smear however remains normochromic and normocytic. This phenomenon is regarded as the “physiologic anemia of pregnancy”.

AIM AND OBJECTIVES

To determine the relationship between the iron status of pregnant women and their newborns using a combination of hematologic and biochemical parameters for the diagnosis of iron-deficiency.

Objectives

1) To find the correlation between the hemoglobin, serum

iron and serum ferritin levels of the neonates with the maternal hemoglobin levels, serum iron and serum ferritin levels.

2) To find the correlation between parity, diet, educational status and occupational status of mother with their hemoglobin levels.

Study Design

MATERIALS AND METHODS

Prospective study conducted at Civil hospital Ahmedabad from January 2020 to December 2020.

Inclusion Criteria

The study was conducted on 60 pregnant women either primi or second gravida delivering singleton live births at term gestation (37-41 weeks) in Civil Hospital Ahmedabad. The pregnant women are selected consecutively, both the mother and neonate were included in study.

Exclusion Criteria

Pregnant females having any one of the following are excluded from the study:

- Premature rupture of membranes (PROM > 24 hrs)
- Fever
- Ante-partum haemorrhage (APH)
- Liver disorders in mothers
- Kidney disorders in mothers
- Women with other systemic illness
- Women who have received blood transfusions.
- Not giving consent for study.

Exclusion Criteria For Neonates

- New borns with congenital malformation.
- Newborns requiring resuscitation at birth

Classification Of Anemia:

Classification of Anemia (Indian Council Of Medical Research) in pregnancy

Hemoglobin level Classification

- <4g/dl Very severe
- 4-6.9 g/dl Severe
- 7-9.9 g/dl Moderate
- 10-10.9 g/dl Mild

Anemia in neonates – During the first 2 weeks of life venous Hb of less than 13g/dl and capillary Hb of less than 14.5g/dl should be regarded as anemia. The normal range of serum ferritin in neonate is 75 to 200ng/ml.

The mothers and their newborns are selected based on this inclusion and exclusion criteria.

The mothers (n=60) were divided into 4 groups:

- Group 1: Hemoglobin <=6.9g/dl
- Group 2: Hemoglobin - 7-9.9g/dl
- Group 3: Hemoglobin -10-10.9g/dl
- Group 4: Hemoglobin >=11g/dl.

Gestational age of the pregnancy was calculated from the first day of the last menstrual period. The calculated gestational age was confirmed by the New Ballard score. Informed consent was taken from the pregnant women after explaining the study protocol and the procedures.

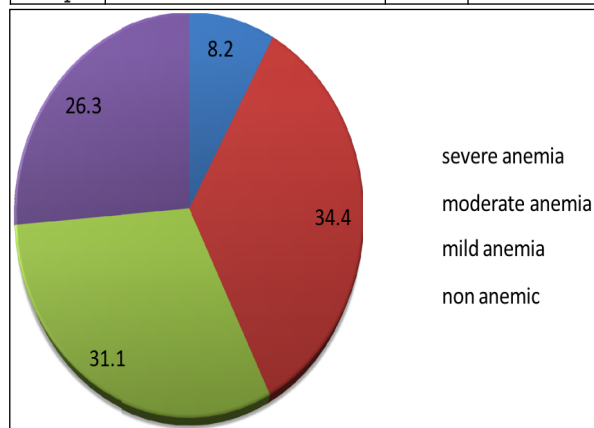
Collection Of Samples And Laboratory Analysis

Maternal blood samples were collected in iron-free polyethylene tubes from the mother's ante-cubital vein during the first stage of labour. Cord blood samples were also collected in iron-free polyethylene tubes from the placental end of the umbilical cord without milking just after the second stage of the labour. From the collected samples hemoglobin, RBC indices, serum iron and serum ferritin were estimated. Hemoglobin and RBC indices are calculated using automated analyser, Serum iron using calorimetry and Serum ferritin using immunohistochemistry.

RESULTS

Classification of pregnant women into 4 groups according to maternal hemoglobin level.

	Hemoglobin g/dl	N	percentage
Group 1	≤ 6.9	5	8.2
Group 2	7 -9.9	21	34.4
Group 3	10-10.9	19	31.1
Group 4	≥ 11	15	26.3



The Results Of My Study Are As Follows:

- Mean value of serum iron in females belonging to group 1 were 28ng/ml and ferritin of 8 ng/ml. Mean value of serum iron in females belonging to group 2 were 44 ng/ml and ferritin of 13 ng/ml. Mean value of serum iron in females belonging to group 3 were 70.7 ng/ml and ferritin of 25.4 ng/ml. Mean value of serum iron in females belonging to group 4 were 77.1 ng/ml and ferritin of 45.8 ng/ml. This shows higher values of iron and ferritin stores in females who are non anaemic as compared to females who are anaemic.

- The values of Hemoglobin, serum iron and serum ferritin are more in the cord blood as compared to maternal serum.
- All newborns in my study had hemoglobin within normal range irrespective of hemoglobin level of mother.
- The mean hemoglobin in newborns of pregnant women in group 1 (severe anaemia) were 15.3g/dl. The mean hemoglobin in newborns of pregnant women in group 2 (moderate anaemia) were 15.7 g/dl. The mean hemoglobin in newborns of pregnant women in group 3 (mild anaemia) were 16.1 g/dl. The mean hemoglobin in newborns of pregnant women in group 4 (no anaemia) were 16.8 g/dl. These values show that hemoglobin values are more in the cord blood than the maternal blood. Also all newborns of females showed had their hemoglobin within normal range. However values of hemoglobin in newborns of non anaemic mother were higher as compared to hemoglobin of newborns of anaemic mother.
- Mean serum iron in newborns of in group 1 (severe anaemia) were 130.6 ng/ml and mean serum ferritin of 65 ng/ml. Mean serum iron in newborns of females in group 2 (moderate anaemia) were 164.4 ng/ml and mean serum ferritin of 118.9 ng/ml. Mean serum iron in newborns of females in group 3 (mild anaemia) were 185.3 and mean serum ferritin of 132.4. Mean serum iron in newborns of females in group 4 (no anaemia) were 187.2 ng/ml and mean serum ferritin of 130 ng/ml. Newborns of females in group 1 shows insufficiency of serum ferritin stores. Serum iron and ferritin were normal in newborns born to females in group 2, 3 and 4.

DISCUSSION

Iron deficiency anemia is the most common nutritional deficiency disorder affecting the pregnant women in our country with a significant impact on fetal mortality and morbidity. In the present study, 60 pregnant women were selected based on the inclusion and exclusion criteria. They were divided into four groups depending on their hemoglobin values according to the classification of anemia in pregnant women by Indian Council of Medical Research. Their newborns are assessed for their hemoglobin and iron status.

In our study the iron related parameters are higher in cord blood as compared to maternal blood. Similar results were obtained in study conducted by Kumar et al in India, Adriana et al in Mangalore, K.V.Shyamala et al in mangalore.

The hemoglobin values of the babies in all the four groups were in the normal range. But they showed a correlation with the maternal hemoglobin levels. Similar results were obtained in study conducted by Kumar et al in India.

Serum ferritin levels showed a positive correlation between the maternal and neonatal blood. There is a significant difference in the serum ferritin values of the cord blood of the babies in the four groups. The serum ferritin level was very low in group of newborn born to severely anaemic mother. The result of my study in this regard is similar to study conducted by Kumar et al in India, Adriana et al in Mangalore, K.V.Shyamala et al in mangalore.

This shows that the serum ferritin levels on the cord blood vary depending on the severity of maternal anemia.

CONCLUSION

From the above findings, it is obvious that a positive correlation exists between the maternal and the neonatal hemoglobin levels. Even though the hemoglobin values of the babies falls in the normal range, their values are low compared to neonates of non anaemic mothers.

The serum iron and serum ferritin values of the neonates correlate with the maternal hemoglobin levels and serum ferritin are very low in the neonates of the mothers with severe iron-deficiency.

The low iron stores of the neonates may be depleted easily and may manifest as anaemia, when the demands are high in early infancy. Iron deficiency in early life may have long term adverse effects on the cognitive development and may also impair cellular immunity. Thus the deleterious effects of maternal anemia extend far beyond pregnancy and early infancy. Effective strategies are needed to control maternal anemia in the developing world.

Improving the iron status of pregnant women by improving the nutrition as well as the regular intake of iron supplements will have a favorable impact on maternal, fetal and infant iron nutrition.

LIMITATION OF STUDY

- 1) The study considered some parameters used to assess iron deficiency like hemoglobin, serum iron and serum ferritin. Other parameters like rbc indices, Total iron binding capacity (TIBC), Transferrin saturation were not included in study.
- 2) The study included only primi and second gravid mothers.

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