

Effect of Maternal Anemia on Placental and Fetal Outcome

Dr. Sowmya Sri. K¹, Dr. Pramod Kumar Korani Ratnam²

¹Resident, Department of Obstetrics and Gynaecology, Osmania Medical College, Hyderabad

²Assistant Professor, Department of General Medicine, Deccan College of Medical Sciences

Abstract: Anemia during pregnancy is very common. More than one-quarter of the world's population is anemic. Growth of the fetus is intricately linked with that of placenta, because placenta helps in transfer of nutrients and oxygen from mother to fetus. Placenta is a focus of increasing interest because significant pathology afflicts the placenta, often before affecting the fetus.

Keywords: Anemia, placenta, fetus

1. Introduction

Anemia during pregnancy is very common. More than one-quarter of the world's population is anemic. Approximately one-half of this burden is a result of iron deficiency anemia, being most prevalent among preschool children and women. More than 70% of pregnant women in developing countries suffer from anemia⁽¹⁾. Functional iron deficiency is a state in which there is insufficient availability of iron (ie, low plasma iron levels and/or low percent transferrin saturation) for incorporation into erythroid precursors in the face of normal or increased body iron stores (ie, normal to increased bone marrow iron stores and/or normal to increased serum ferritin levels)^(2,3).

Total iron content of the body depends on age, sex and body weight of the person. In an average adult female it is 2-2.5gms⁽⁴⁾. Placental abnormalities can be an 'early warning system' for fetal problems. The evaluation of placenta thus becomes essential in high risk pregnancy⁽⁵⁾. Maternal anemia leading to low birth weight and perinatal mortality⁽⁶⁾. Naoko kozuki⁽⁷⁾ et al conducted a meta-analysis study and found that moderate to severe anemia appears to have an association with SGA outcomes. Iron deficiency anemia contributes to more than 90% cases of anemia complicating pregnancy being responsible for 19% of maternal deaths⁽⁸⁾.

2. Patients and Methods

Prospective cross sectional study of pregnant cases admitted in the Department of Obstetrics and Gynecology, osmania medical college over a period of 24months which includes 40 randomly selected subjects, belonging to Control, mild, moderate and severe anemia groups. Anemia due to causes other than IDA, with associated medical disorders and obstetrical complications like preeclampsia, multiple gestation, antepartum hemorrhage were excluded.

3. Observations

In the present study, multigravidae represent 72.5% of the total study Population.

In the control group, multigravidae represent 70% of the controls while in the anemic study population they represent 75.8% of the anemic group

Age Wise Distribution of Study Population:

In the present study, 47.5% belong to 23-27 years age group. 50% of the control population belongs to 23-27 yrs age group and the rest 50% to 18-22yrs age group. In the anemic group, 46.6% belong to 23-27yrs age group, 36.6% belong to 18-22yrs age group and the rest 16.8% to 28-32yrs age group.

Birth Weight Categorization

	Control	Mild	Moderate	Severe	Total
<1.5 kg					
1.5-2kg				1	1
2.1-2.5kg	4	4	5	9	22
2.6-3kg	5	4	4		13
>3kg	1	2	1		4

In the present study, 50% newborns were in the birth weight range of 2.1-2.5kgs. In the control group, 50% of the new born birth weights were in the range of 2.6-3kg. In the anemic group, 60% of the newborns were in the birthweight range of 2.1-2.5kg and 26.6% were in the range of 2.6-3kg and 10% were >3kg

Mode of Delivery in the Study Population

In the control population 60% population had LSCS as the mode of delivery. In the study population, 60% delivered vaginally while 40% underwent LSCS

Distribution of Cord Blood Hemoglobin

Cord blood Hb%	Control	Mild	Moderate	Severe	Total
<13.7gm/dl	0	0	2	3	5
13.7-20.1gm/dl	10	10	8	7	35

In the present study, 12.5% newborns had cord blood hemoglobin less than 13.7gm/dl, considering a level of 13.7-20.1gm/dl(9) to be the normal range. In the present study, cord blood hemoglobin of all the newborns in the control group were in the normal range of 13.7-20.1gm/dl. While 16.6% of the newborns in the anemic group had cord blood hemoglobin less than 13.7gm/dl, rest of the 83.4% had hemoglobin in the normal range

Distribution of Vascularity Per Villi

Villous Vascularity	Control	Mild	Moderate	Severe	Total
Normal (2-6%)	7	5	4	2	18
Increased	3	5	6	8	22

In the present study, 57.5% of the population show increased vascularity. In the present study, 30% of the control population shows increased vascularity, while 66.6% of the anemic group shows increased vascularity.

Distribution of Syncytial Knots

Syncytial Knots	Control	Mild	Moderate	Severe	Total
Normal (11-30%)	7	5	3	2	17
Increased	3	5	7	8	23

In the present study, increased syncytial knots are noted on placental HPE in 57.5% of the population. In the control population increased syncytial knots are noted on placental HPE in 30% of the population, while it is noted in 66.6% of the population in the anemic group.

Distribution of Intravillous Fibrinoid Necrosis

Intravillous Fibrinoid necrosis	Control	Mild	Moderate	Severe	Total
Normal (<3%)	9	5	3	1	18
Increased	1	5	7	9	22

In the present study, 55% of the study population shows increased intravillous fibrinoid necrosis on placental HPE. In the control group, 10% of the population show increased intravillous fibrinoid necrosis while in the anemic group, 70% of the population shows increased intravillous fibrinoid necrosis on placental HPE.

The Distribution of Intervillous Stromal Fibrosis

Intervillous Stromal fibrosis	Control	Mild	Moderate	Severe	Total
Normal (< 3%)	7	6	4	2	19
Increased	3	4	6	8	21

In the present study, increased intervillous stromal fibrosis was noted in 52.5% of population on placental HPE.

4. Discussion

In this present study a total 40 subjects were studied 10 each belonging to control, mild moderate and severe anemia groups. Hemoglobin, serum ferritin estimation, peripheral smear examination and MCV, MCH was determined for each of the cases. At the time of delivery, birth weight and length of the newborn were determined. Cord blood was collected at the time of delivery for hemoglobin and serum ferritin estimation.

In the present study, taking a birth weight of 2.5kg as cutoff, control and anemic population were grouped into those whose newborns were more than or equal to 2.5kg and those whose newborns were below that.

According to this distribution Birthweight <2.5kg control are 1, anemic are 15 and Birthweight ≥2.5kg control are 9, anemic are 15 there shows there exists a significant association between maternal anemia and low birth weight.

This is comparable to a study conducted by Amalia Levy et al⁽¹⁰⁾.

Maternal Serum Ferritin Vs Birth Weight

In the present study, there was no significant association between maternal serum ferritin concentration and birth weight of newborn among control, mild and moderate anemic mothers.

On the contrary there was significant association between maternal serum ferritin concentration and birth weight of newborn when the maternal hemoglobin falls below 7gm/dl.

Maternal Hemoglobin Vs Cord Blood Hemoglobin

In the present study, the correlation coefficient between maternal hemoglobin and cord blood hemoglobin in control, mild and moderate anemia cases there was no significant association between maternal hemoglobin concentration and cord blood hemoglobin.

While in the severe anemia cases there is a significant positive association maternal and cord blood hemoglobin concentrations.

Compared to study AarthiSareen(11).

Maternal Hemoglobin Vs Cord Blood Ferritin

In the present study, the correlation coefficient between maternal hemoglobin concentration and cord blood serum ferritin among control, mild and moderate anemia subjects there was no significant association between maternal hemoglobin concentration and cord blood serum ferritin concentration.

On the contrary the correlation coefficient between maternal hemoglobin concentration and cord blood serum ferritin in severe anemia cases here exists a significant positive correlation between maternal hemoglobin concentration and cord blood serum ferritin concentration in the newborn as maternal anemia worsens.

Maternal Ferritin Vs Cord Blood Ferritin

In the present study, the correlation coefficient between maternal and cord blood serum ferritin concentration was 0.77387 which implied that there positive correlation exists a significant positive correlation between maternal and cord blood serum ferritin concentrations. This is comparable to study conducted by Erdem.A et al⁽¹²⁾.

Maternal Hemoglobin Vs Length of New Born

In the present study, the correlation coefficient between maternal hemoglobin and Length of the newborn among control, mild, moderate and severe anemia subjects exists no significant association between maternal hemoglobin concentration in control, mild and moderate anemia groups, while a significant positive correlation exists between maternal hemoglobin and length of the newborn in severe anemia group.

Association between low birth weight and villous vascularity on placental HPE. In this distribution of among birthweight <2.5kg 6 of them have normal villous vascularity, 10 of them have increased villous vascularity and among birthweight ≥2.5kg 11 of them have normal villous vascularity, 13 of them have increased villous vascularity. From this distribution there exists no significant association between birth weight and villous vascularity on placental HPE among the study population.

Association between anemic group and villous vascularity on placental HPE. In this distribution among controls 7 of them have normal villous vascularity, 3 of them have increased villous vascularity and among anemic 10 of them have normal villous vascularity, 20 of them have increased villous vascularity. From this distribution that there exists no significant association between maternal anemia and increased villous vascularity on placental HPE.

Association between birth weight and syncytial knots on placental HPE. In this distribution of among birthweight <2.5kg 3 of them have normal syncytial knots, 13 of them have increased syncytial knots and among birthweight ≥2.5kg 13 of them have normal syncytial knots, 11 of them have increased syncytial knots. From this distribution there exists a significant association between birth weight of newborn and increased syncytial knots on placental HPE.

Association between anemic group and syncytial knots on placental HPE. In this distribution of among control 7 of them have normal syncytial knots, 3 of them have increased syncytial knots and among anemic 10 of them have normal syncytial knots, 20 of them have increased syncytial knots. From this distribution there exists a significant association between anemia and increased syncytial knots on placental HPE.

Association between birthweight and intravillous fibrinoid necrosis on placental HPE. In this distribution of among birthweight <2.5kg 4 of them have normal intravillous fibrinoid necrosis, 12 of them have increased intravillous fibrinoid necrosis and among birthweight ≥2.5kg 15 of them have normal intravillous fibrinoid necrosis, 9 of them have increased intravillous fibrinoid necrosis. From this distribution there exists a significant association between low birth weight and increased intravillous fibrinoid necrosis on placental HPE.

Association between anemic group and intravillous fibrinoid necrosis on placental HPE. In this distribution among controls 9 of them have normal intravillous fibrinoid necrosis, 1 of them have increased intravillous fibrinoid necrosis and among anemic 9 of them have normal intravillous fibrinoid necrosis, 21 of them have increased intravillous fibrinoid necrosis. From this distribution there exists a significant association between maternal anemia and increased intravillous fibrinoid necrosis on placental HPE.

Association between birthweight and intervillous stromal fibrosis on placental HPE. In this distribution of among birthweight <2.5kg 4 of them have normal

intervillous fibrinoid necrosis, 12 of them have increased intervillous fibrinoid necrosis and among birth weight ≥2.5kg 16 of them have normal intervillous fibrinoid necrosis, 8 of them have increased intervillous fibrinoid necrosis. From this distribution there was a significant association between low birth weight and increased intervillous stromal fibrosis.

Association between anemic and intervillous stromal fibrosis on placental HPE. In this distribution among controls 8 of them have normal intervillous stromal fibrosis, 2 of them have increased intervillous stromal fibrosis and among anemic 12 of them have normal intervillous stromal fibrosis, 18 of them have increased intervillous stromal fibrosis. From this distribution there exists a significant association between maternal anemia and increased intervillous stromal fibrosis on placental HPE.

5. Conclusions

Mild and moderate maternal anemia does not affect birth weight, length, newborn hemoglobin levels, cord blood ferritin and length of the newborn. Severe maternal anemia has a great impact on birth weight, newborn hemoglobin and ferritin levels. Hence inference from present study is to detect maternal anemia at the earliest in a less severe form so that deleterious effects on the foetus in severe anemia can be prevented.

References

- [1] Kalaivani K. Prevalence & consequences of anemia in pregnancy. Indian J Med Res. 2009 Nov; 130(5): 627-33.
- [2] Goodnough L T, Nemeth E, Ganz T. Detection, evaluation, and management of iron-restricted erythropoiesis. Blood. 2010; 116(23): 4754.
- [3] Thomas D W, Hinchliffe R F, Briggs C, Macdougall I C, Littlewood T, Cavill I. Guideline for the laboratory diagnosis of functional iron deficiency. Br J Haematol. 2013 Jun; 161(5): 639-48.
- [4] William J S, Thurnau G R. Iron deficiency anemia in Pregnancy. Clin Obstet Gynecol 1995; 38(3): 443-453.
- [5] Mc Ardle H J, Danzeisen R, Fosset C, Gambling L. The role of the placenta in iron transfer from mother to fetus and the relationship between iron status and fetal outcome. Bio metals 2003 Mar; 16(1): 161-7.
- [6] Adam I, Babiker S, Ahmed A, Mohammed, Salih M M, Prince M H, Zaki Z M. Low Body Mass Index, Anemia and Poor Perinatal Outcome in a Rural Hospital in Eastern Sudan. J Trop Pediatr 2008; 54 (3): 202-204.
- [7] Kozuki N, Lee A C, Katz J. Moderate to Severe Anemia, but Not Mild, Maternal Anemia is associated with Increased risk of Small for Gestational age Outcomes. J.Nutr, 2012; 142(2): 358-362.
- [8] Indian Council of Medical Research. Task Force study: Evaluation of National Nutritional Anemia prophylaxis programme. ICMR New Delhi 1989
- [9] Finch C A, Bellotti V, Stray S, Lipschitz D A, Cook J D, Pippard M J et al. Plasma ferritin determination as a diagnostic tool. West J Med. 1986; 145(5): 657.
- [10] Levy A, Fraser D, Katz M, Mazor M, Sheiner E. Maternal Anaemia during pregnancy is an independent

risk factor for low birth weight and preterm delivery.
European journal of Obs & Gyn and Reproductive
biology, 2005; 122(2); 182-186.

- [11] Sareen A, Mahajan K, Singh S. Maternal anaemia and its Effects on Cord Hemoglobin. Indian Medical Gazette, May 2013; 161-163.
- [12] Erdem A, Erdem M, Arslan M, Yazici G, Eskandari R, Himmetoglu O. The effect of Maternal Anaemia and Iron Deficiency on Fetal Erythropoiesis: Comparison between serum erythropoietin, hemoglobin and ferritin levels in mothers and newborns. Journal of Maternal-Fetal and Neonatal Medicine, 2002; 11(5); 329-332.