

Evaluation of RBC Count and Haemoglobin Concentration in Newborn of Mother with and without Preeclampsia

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Abstract

Original Research Article

Introduction: Preeclampsia (PE) is one of the commonest complications in pregnancy which is associated with perinatal mortality and morbidity. Early hematological screening of the newborn of preeclamptic mother may be helpful to diagnose and treat the newborn of preeclamptic mother for better pregnancy outcome. **Aim of the Study:** The aim of this study was to evaluate the RBC count and Haemoglobin concentration in newborn of mother with and without preeclampsia. **Methods:** This cross-sectional study was conducted in the Department of Physiology, Dhaka Medical College, Dhaka, Bangladesh from January 2017 to December 2017. Total 60 newborns were included in this study. The subjects were divided into 2 groups. Group A (Study group): Thirty (30) newborns of preeclamptic mother and Group B (Control group): Thirty (30) newborns of healthy pregnant mother. The subjects were selected from Department of Obstetrics and Gynecology, Dhaka Medical College Hospital, Dhaka on the basis of exclusion and inclusion criteria. Five (5) ml. of cord blood was collected from each newborn after delivery and was analyzed for complete blood count. These parameters were estimated in the Department of Hematology, Dhaka Medical College Hospital, Dhaka. Data were collected in pre- designed structured questionnaire form by the researcher herself. For statistical analysis Unpaired Student's "t" test, Chi Square test and Pearson's correlation coefficient (r) test were performed as applicable using SPSS for windows version 16.0. p value <0.05 was accepted as level of significance. **Results:** In this study, the mean (\pm SD) maternal systolic blood pressure of the study group A and control group B were 173.00 ± 19.73 and 114.83 ± 11.72 mm Hg respectively. In this study, the mean (\pm SD) maternal systolic blood pressure was significantly ($p < 0.001$) higher in group A in compared to group B. The mean (\pm SD) maternal diastolic blood pressure of the study group A and control group B were 108.33 ± 9.52 and 73.33 ± 9.07 mm Hg respectively. In this study, the mean (\pm SD) maternal diastolic pressure was significantly ($p < 0.001$) higher in group A in compared to group B. The mean (\pm SD) Hb concentration was 17.89 ± 2.77 and 14.20 ± 2.19 g/dl in group A and B respectively. In this study, the mean (\pm SD) Hb concentration was significantly ($p < 0.001$) higher in group A in comparison to group B. The mean (\pm SD) RBC count was $5.55 \pm 1.40 \times 10^6/\mu\text{l}$ and $4.47 \pm 0.37 \times 10^6/\mu\text{l}$ in group A and B respectively. In this study, the mean (\pm SD) RBC count was higher in group A in comparison to that of group B which was statistically significant ($p < 0.001$). Maternal systolic blood pressure showed positive correlation ($r = + 0.909$) with Hb concentration in newborn of preeclamptic mother, which was statistically significant (< 0.001). Maternal diastolic blood pressure showed positive correlation ($r = + 0.960$) with Hb concentration in newborn of preeclamptic mother, which was statistically significant (< 0.001). Maternal systolic blood pressure showed positive correlation ($+ 0.901$) with RBC count in newborn of preeclamptic mother, which was statistically significant (< 0.001). Maternal diastolic blood pressure showed positive correlation ($+ 0.895$) with RBC count in newborn of preeclamptic mother, which was statistically significant (< 0.001). **Conclusion:** This study concluded that cord blood haemoglobin concentration and RBC count in newborn of preeclamptic mother were significantly altered in comparison to newborn of normal pregnant mother. But they were within normal range. These changes were significantly related to severity of maternal blood pressure.

Keywords: RBC Count, Haemoglobin concentration, Newborn of Mother with and without Preeclampsia.**Copyright © 2022 The Author(s):** This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

I. INTRODUCTION

Pregnancy is a physiological process. Various anatomical, physiological, biochemical and endocrine

changes are associated with pregnancy that affects multiple organs and systems. The aim of these changes is to adjust the mother to the pregnant state and to aid the fetal growth and development [1]. Some

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complications may arise during pregnancy which may affect the maternal and fetal wellbeing and require careful management for a better pregnancy outcome. Preeclampsia is a common complication of pregnancy. It complicates about 2%-8% of all the pregnancies and is a leading cause of fetal and maternal mortality and morbidity [2]. Preeclampsia is a multisystem disorder characterized by new onset of development of hypertension with proteinuria after 20 weeks of gestation [3]. Preeclampsia can be categorized into mild and severe forms. Mild preeclampsia is defined as blood pressure of at least 140/90mm of Hg with proteinuria at least 300mg per 24-hour urine collection or equal to 1+ on urinary dipstick test. Severe preeclampsia is associated with blood pressure \geq 160/110mm of Hg on two occasions at least 6 hours apart with proteinuria \geq 5gm in a 24-hour urine collection or 3+ on urinary dipstick test [4]. The outcome of preeclampsia sometimes can be life threatening. Fetal complications include placental abruption, intrauterine growth restriction (IUGR), premature delivery, increased risk of perinatal death and after birth requirement of support of neonatal intensive care unit. Acute maternal complications associated with preeclampsia are eclampsia, pulmonary oedema, stroke, placental abruption, disseminated intravascular coagulation (DIC), HELLP (hemolysis, elevated liver enzymes, low platelets) syndrome, liver hemorrhage or ruptures, adult respiratory distress syndrome, acute renal failure and death. Long term effects on mother include chronic hypertension, diabetes mellitus, coronary artery disease, neurological deficit and premature death [5, 6]. Newborn babies of preeclamptic mothers may have risk for polycythemia [20], sepsis, bleeding tendencies including intracranial hemorrhage. Perinatal outcome of these newborns may be by maternal disease and pharmacological intervention given to the mother. Therefore, early hematological screening of these newborns is recommended to diagnose and treat them early to reduce the perinatal morbidity and mortality [7]. Several studies have been done around the world to observe the effects of preeclampsia on newborn blood parameters. As, there is less published data available regarding this topic in Bangladesh, the effect of preeclampsia on the blood parameters of newborn is not precisely known. This study may be helpful to create awareness among the pregnant mothers and the clinicians of Bangladesh regarding the effects of preeclampsia on the newborn and its future complications. Thus, this current study was conducted to evaluate the RBC count and Haemoglobin concentration in newborn of mother with and without preeclampsia.

II. OBJECTIVES

To evaluate the RBC count and Haemoglobin concentration in newborn of mother with and without preeclampsia.

III. METHODOLOGY & MATERIALS

This cross-sectional study was conducted in Department of Physiology, Dhaka Medical College, Dhaka, Bangladesh during the period from January 2017 to December 2017. Total 60 newborns were included in this study. The subjects were divided into 2 groups. Group A (Study group): Consisted of thirty (30) newborns of preeclamptic mother and Group B (Control group): Consisted of thirty (30) newborns of healthy pregnant mother. The subjects were selected from eclampsia ward, labor ward and observation ward of the Department of Obstetrics and Gynaecology, Dhaka Medical College Hospital on the basis of inclusion and exclusion criteria. Purposive sampling technique was used for sampling. After selection of the pregnant women, the nature, purpose and benefit of the study were explained to the pregnant women and their parents or legal guardians in details and informed written consent was taken from the pregnant women, their parents/legal guardians. The research work was carried out after obtaining ethical clearance from concerned Departments, Research Review Committee and Ethical Review Committee of Dhaka Medical College, Dhaka. Before taking blood, detailed personal history, family history and medical history with onset of symptoms, blood pressure recording and presence of seizures of the pregnant women were noted. Urine sample (10ml) was collected in a plain and dry glass test tube for urinary dipstick test. With all aseptic precaution after delivery of newborn 5 ml cord blood was collected by a 10-cc disposable plastic syringe in a tube containing 1.5 mg EDTA from each newborn. Then blood samples were sent for hematological analysis in the Department of Hematology, Dhaka Medical College Hospital, Dhaka. Collected blood samples were analyzed by Automated Hematology Analyzer (Sysmex XT-2000). Details of the labor including mode of delivery, duration of labor, rupture of membrane and presence of any complications during labor were recorded. Neonatal data such as sex, date of delivery, time of birth, Apgar scores at 1st and 5th min, birth weight were recorded in prefixed questionnaire. Complete blood count was estimated in Department of Hematology, Dhaka Medical College Hospital, Dhaka. All the parameters were expressed as mean and standard deviation (mean \pm SD). Unpaired Student's 't' test was performed to compare all the quantitative parameters between the two groups. Chi Square test was performed to the qualitative parameters between the groups. Pearson's correlation co-efficient (r) test was performed to observe the relationship of hematological changes in newborn of preeclamptic mother. p value <0.05 was accepted as level of significance. Statistical analyses were performed by using a computer based statistical program SPSS (statistical package for social sciences) version 16.0.

Inclusion Criteria For both groups:

1. Newborn of both sexes within one hour of delivery.

Inclusion criteria for Group A:

1. Newborn of mother diagnosed as preeclampsia.⁸

Inclusion criteria for Group B:

1. Newborn of healthy pregnant mother.

Exclusion Criteria for both groups:

1. Newborn of mother with pre-existing hypertension, diabetes mellitus, severe anemia, heart disease, liver disease, kidney disease, Rh incompatibility and ABO incompatibility.
2. Newborn of mother with habit of smoking, premature rupture of membrane.
3. Newborn of mother with history of taking drug like aspirin.
4. Newborn with perinatal infections, chromosomal anomaly, congenital malformation.

IV. RESULTS

A total number of 60 newborns were selected for this study. Among them, 30 newborns of preeclamptic mother were selected as study group (Group A) and 30 sex matched newborns of healthy mother were selected as control (Group B) for comparison. Table I demonstrates the general characteristics of the subjects in both groups. In this study, the maternal age range of the study population was between 15-40 years. The mean (\pm SD) maternal age of study group A and control group B were 24.12 ± 5.49 and 24.00 ± 4.83 years respectively. No statistical difference was observed between these two groups. So, maternal age was matched between two groups. In this study, there were 19 primi and 11 multi para pregnant women in study group A and 18 primi and 12 muti para pregnant women in control group B. No statistical difference was observed between these two groups. So, maternal parity was matched between two groups. The mean (\pm SD) gestational age (weeks) was 35.70 ± 2.28 and 38.03 ± 1.22 weeks in study group A and control group B respectively. In this study, the mean (\pm SD) gestational age (weeks) was significantly ($p < 0.001$) lower in group A in comparison to that of group B. The mean (\pm SD) maternal systolic blood pressure of the study group A and control group B were 173.00 ± 19.73 and 114.83 ± 11.72 mm Hg respectively. In this study,

the mean (\pm SD) maternal systolic blood pressure was significantly ($p < 0.001$) higher in group A in comparison to that of group B. In the study group A, 15(50%) newborns were male and 15(50%) newborns were female. In the control group B, 15 (50%) newborns were male and 15(50%) newborns were female. No statistical difference was observed between these two groups. Therefore, newborns of both the groups were matched for sex. The mean (\pm SD) maternal diastolic blood pressure of the study group A and control group B were 108.33 ± 9.52 and 73.33 ± 9.07 mm Hg respectively. In this study, the mean (\pm SD) maternal diastolic pressure was significantly ($p < 0.001$) higher in group A in comparison to that of group B. The mean (\pm SD) Hb concentration was 17.89 ± 2.77 g/dl and 14.20 ± 2.19 g/dl in group A and B respectively. In this study, the mean (\pm SD) Hb concentration was significantly ($p < 0.001$) higher in group A in comparison to that of group B. The results were shown in Table II and Figure 1. The mean (\pm SD) total count of RBC was $5.55 \pm 1.40 \times 10^6/\mu\text{l}$ and $4.47 \pm 0.37 \times 10^6/\mu\text{l}$ in group A and B respectively. In this study, the mean (\pm SD) RBC count was higher in group A in comparison to that of group B which was statistically significant ($p < 0.001$). The results were shown in Table II and Figure 2. Correlation between maternal blood pressure and Hb concentration in newborn of preeclamptic mother were shown in Table III and Figure 4. Maternal systolic blood pressure showed positive correlation ($r = + 0.909$) with Hb concentration in newborn of preeclamptic mother, which was statistically significant (< 0.001). Maternal diastolic blood pressure showed positive correlation ($r = + 0.960$) with Hb concentration in newborn of preeclamptic mother, which was statistically significant (< 0.001). Correlation between maternal blood pressure and RBC count in newborn of preeclamptic mother were shown in Table III and Figure 3. Maternal systolic blood pressure showed positive correlation ($+ 0.901$) with RBC count in newborn of preeclamptic mother, which was statistically significant (< 0.001). Maternal diastolic blood pressure showed positive correlation ($+ 0.895$) with RBC count in newborn of preeclamptic mother, which was statistically significant (< 0.001).

Table-I: General characteristics of the subjects in both groups (N=60)

Parameters		Group-A	Group-B	p value
		Newborns of preeclamptic mother (n=30)	Newborns of healthy mother (n=30)	
Maternal age (years) ^a	Mean \pm SD	24.12 ± 5.49	24.00 ± 4.83	0.929 ^{ns}
Para ^b	Primi	19 (63.3%)	18 (60%)	0.791 ^{ns}
	Multi	11 (36.7%)	12 (40%)	
Gestational age (weeks) ^a	Mean \pm SD	35.70 ± 2.28	38.03 ± 1.22	< 0.001 ***
Sex of newborn (%) ^b	Male	15 (50%)	15 (50%)	1.000 ^{ns}
	Female	15 (50%)	15 (50%)	
Systolic BP of mother ^a (mmHg)	Mean \pm SD	173 ± 19.73	114.83 ± 11.72	< 0.001 ***
Diastolic BP of mother ^a (mmHg)	Mean \pm SD	108.33 ± 9.52	73.33 ± 9.07	< 0.001 ***

Results were expressed as mean \pm SD, a=Unpaired Student's 't' test, b=Chi Square test, The test of significance was calculated and p value < 0.05 was accepted as level of significance, N= total number of subjects, n = number of subjects in each group, ***= highly significant, ns=not significant

Table-II: Study parameters of the subjects in both groups (N=60)

Parameters	Group-A	Group-B	p value
	Newborns of preeclamptic mother (n=30)	Newborns of healthy mother (n=30)	
Hb concentration (g/dL) ^a	17.89 ± 2.77	14.20 ± 2.19	<0.001***
RBC count (x 10 ⁶ /μl) ^a	5.55 ± 1.40	4.47 ± 0.37	<0.001***

Results were expressed as mean ± SD, a=Unpaired Student's 't' test, The test of significance was calculated and p value < 0.05 was accepted as level of significance, N= total number of subjects, n = number of subjects in each group, ***= highly significant, *= significant, ns= not significant

Table III: Correlation of maternal blood pressure with study parameters in study group (n=30)

Study parameters	Systolic blood pressure		Diastolic blood pressure	
	R	P	r	p
Hb (g/dL)	+ 0.909	<0.001***	+ 0.960	<0.001***
Total count of RBC (x10 ⁶ /μl)	+ 0.901	<0.001***	+ 0.895	<0.001***

Pearson's correlation coefficient (r) test was performed to observed relationship between maternal blood pressure with different study parameters. The test of significance was calculated and p value < 0.05 was accepted as level of significance. ***= highly significant, **= significant, ns= not significant, n = number of subjects in each study group

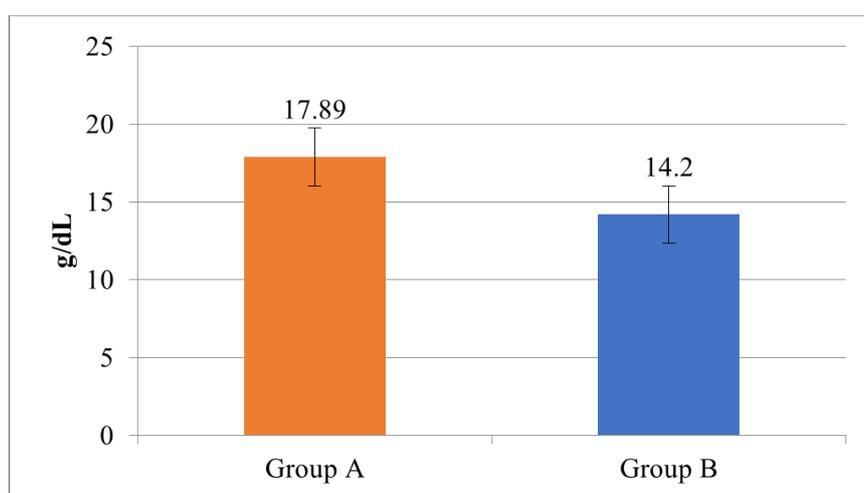


Figure-1: Mean Hb concentration in both groups (N=60)

Group A: Newborns of preeclamptic mother, Group B: Newborns of healthy mother, N= total number of subjects, Hb= Haemoglobin concentration

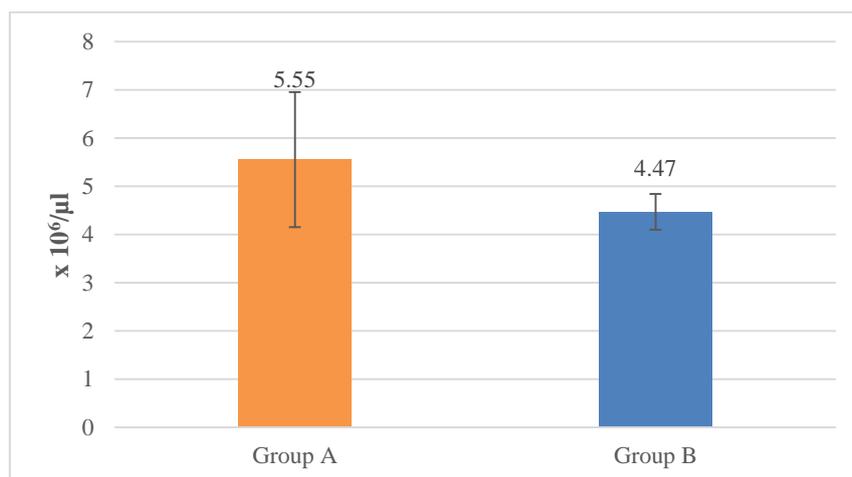


Figure-2: Mean total count of RBC in both groups (N=60)

Group A: Newborns of preeclamptic mother, Group B: Newborns of healthy mother, N= total number of subjects, RBC= Red blood cell

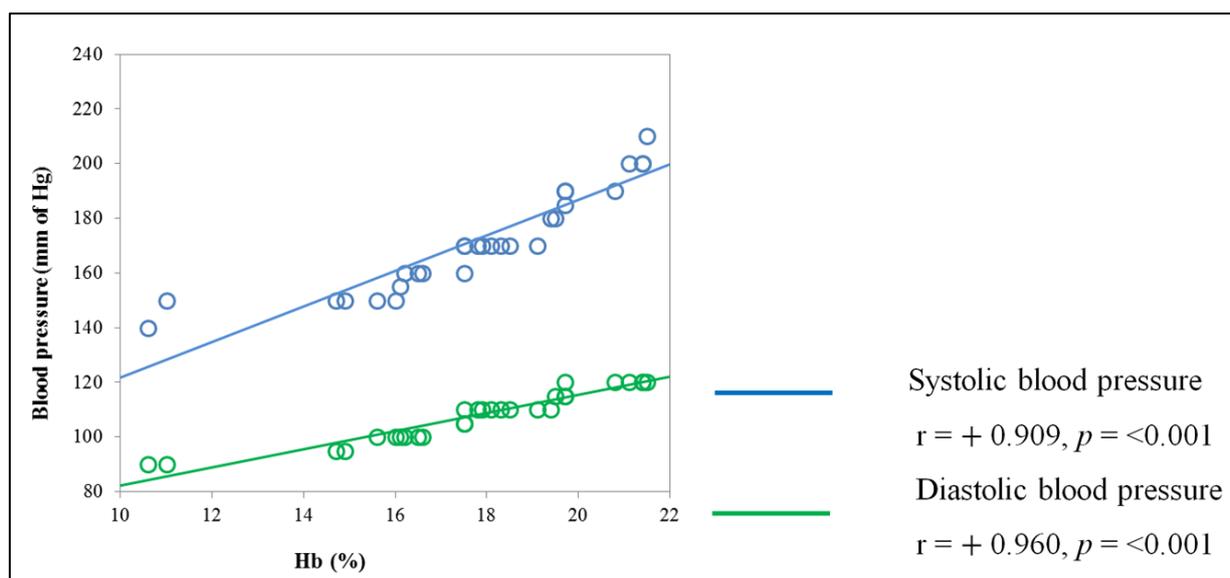


Figure-3: Correlation of Hb concentration with systolic and diastolic blood pressure in study group (n=30)
n = number of subjects in study group, Study subjects: Newborns of preeclamptic mother

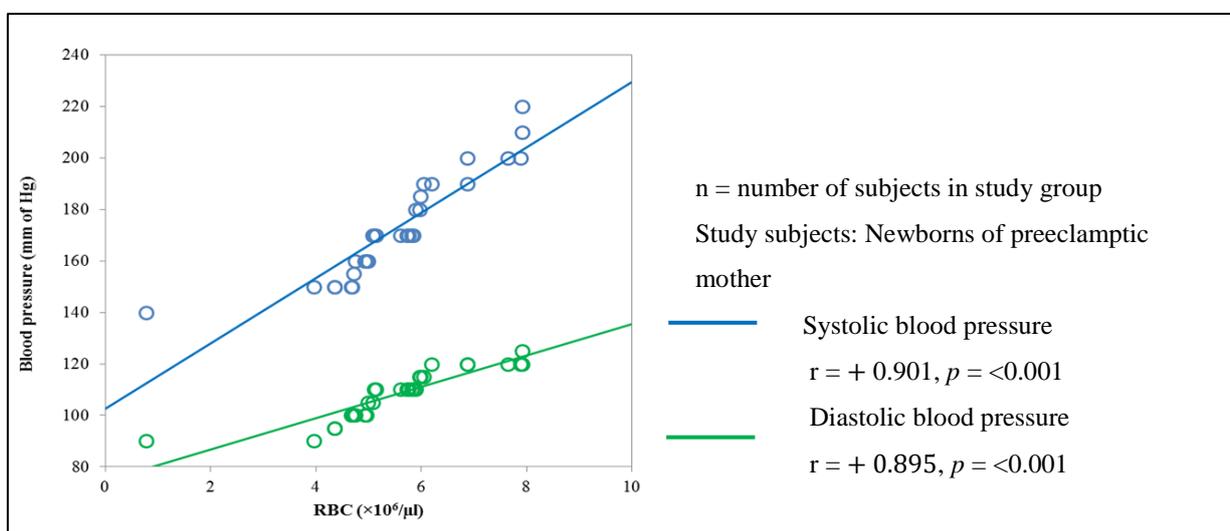


Figure 4: Correlation of total count of RBC with systolic and diastolic blood pressure in study group (n=30)
n = number of subjects in study group, Study subjects: Newborns of preeclamptic mother

V. DISCUSSION

In the present study, all the parameters in newborns of healthy pregnant women were within physiological limit. Almost similar types of findings were observed by various investigators from different countries [9-11]. In the present study, the maternal blood pressure was higher in group A than that of group B and the result was statistically significant ($p < 0.001$). This finding was in agreement with the study of many researchers of different countries [12-14]. In the present study, the mean RBC count and Hb concentration ($p < 0.001$) higher in newborns of preeclamptic mothers than that of healthy newborns of healthy pregnant mothers. Similar types of observations were found by some researchers of different countries [15-17]. They observed RBC count and Hb concentration were significantly higher in newborns of preeclamptic mothers which were consistent with the present study.

On the contrary, Prakash *et al.*, [18] and Catarino *et al.*, [19] found no significant changes in Hb concentration and RBC count in newborn of preeclamptic mother than that of newborn of healthy pregnant mother. This disagreement in findings might have occurred due to inhibitory factors produced due to hypertensive disorders. The balance between the response of hypoxia and the inhibitory factors may lead to increase or decrease in erythropoiesis. Different methodology was used in those studies. In the present study, Pearson's correlation (r) test was done to observe the relationships between Hb concentration and RBC count of the study group with severity of maternal blood pressure. In this study Hb concentration and RBC count showed positive correlation with severity of maternal blood pressure. The relationship was statistically significant in case of Hb concentrations and RBC count. In the present study, of hemoglobin concentration and RBC count in

newborn of preeclamptic mother showed positive correlation with severity of maternal blood pressure.

In preeclampsia, there is abnormal placentation due to defective invasion of spiral arteries by cytotrophoblast cells. In normal pregnancy, spiral arterioles of the uterus are converted to low pressure high flow system to maintain adequate blood flow to the placenta and the developing fetus. The cytotrophoblasts invade up to the inner third of the myometrium. The spiral arteries lose endothelium with most of the muscle fibers. So, the arteries become less sensitive to vasoconstrictor substances. In PE, the cytotrophoblastic invasion is incomplete. The uterine arteries cannot remodel to low pressure, dilated vessels. The higher arterial resistance leading to chronic placental ischemia. This leads to placental hypoxia and oxidative stress and release of angiogenic factors, cytokines and products of lipid peroxidation etc [21]. Some researcher suggested that prolonged placental hypoperfusion in preeclampsia causes hypoxic response in developing fetus. This leads to over expression of hypoxia inducible factors. Hypoxia inducible factor-1 binds to hypoxia response element in the erythropoietin gene and induces transcription of mRNA. This increases erythropoietin synthesis which induces erythropoiesis and blocks apoptosis in the late erythroid progenitors (colony forming units-erythroid, CFU-Es). Erythropoietin enhances proliferation and differentiation of the progenies and also increases the rapidity of red cell production to meet up the imbalance of oxygen demand [13]. This active fetal erythropoiesis may result in finding of high RBC count and hemoglobin concentration [11, 16].

Limitations of the Study

Although optimal care had been tried by the researcher in every step of the study, but there were some limitations. Evaluation of hematological parameters in preeclamptic mothers was not done financial constraints.

VI. CONCLUSION AND RECOMMENDATIONS

After analyzing the results of the study, it can be concluded that cord blood hematological parameters of newborn of preeclamptic mother were significantly altered in comparison to newborn of normal pregnant mother but they were within normal range. These changes were significantly related to severity of maternal blood pressure. It is evident by significantly increased hemoglobin concentration and RBC count in newborn of preeclamptic mother. To make more conclusive results, evaluation of hematological parameters in preeclamptic mothers could be done to compare with the hematological changes of the newborn.

Conflict of Interest: None.

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