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ORIGINAL ARTICLE

Serum Hemoglobin Level in Preeclampsia

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Abstract

Background: Pre-eclampsia is the major cause of maternal and fetal mortality and morbidity. It affects approximately 5-8% of pregnant women. **Objectives**: The study was undertaken to find an association between Hemoglobin and preeclampsia. **Methodology:** This cross-sectional study was carried out in the Department of Physiology at Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh from July 2009 to June 2010. For this, 60 pregnant women of preeclampsia, age ranged from 18 to 39 years, more than 20th weeks of pregnancy were included in the study (group B). They were further divided into group B_1 consisting of 30 mild preeclamptic women and group B_2 consisting of 30 severe preeclamptic women. For comparison age and gestational period matched 30 normotensive pregnant women control (group A) were also studied. Both control (group A) and preeclamptic women were selected from Obstetric and Gynae in and out patient Department of BSMMU and Dhaka Medical College Hospital. Maternal hemoglobin concentration was measured by standard laboratory techniques. **Result:** In this study, hemoglobin levels were significantly higher in study (group B) than those of control (group A). Again Hemoglobin levels were higher in group B_2 than B_1, but not significant ($P>0.05$). Hemoglobin level was positively correlated with systolic and diastolic blood pressure but it was statistically non-significant ($P>0.05$). **Conclusion:** The study concluded that serum hemoglobin level is associated with preeclampsia. [*Journal of Current and Advance Medical Research, January 2021;8(1):39-43*]

Key words: Preeclampsia; hemoglobin; pregnancy

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Introduction

Pre-eclampsia is a multisystem disorder of unknown etiology and is unique to pregnant women after twenty weeks of gestation. It is a progressive disease with a variable mode of presentation and rate of progression[1]. Preeclampsia occurs in about 6.0% of the general population[2]. The incidence varies with geographic location. Predisposing factors are nulliparity black race, maternal age below 20 or over 35 years, low socioeconomic status, multiple gestation, hydatidiform mole, polyhydramnios, twins, obesity and underlying renal disease[4].

Preeclampsia is also believed to be responsible for 15.0% of premature deliveries and 17.6% of maternal death worldwide. The disease is mild in 75.0% of cases and severe in 25.0% of all cases of preeclampsia and 10.0% occur in pregnancies of less than 34 weeks gestation[6]. Most cases of preeclampsia are mild, and 90.0% occur after 34 weeks' gestation. Earlier cases of preeclampsia tend to be more severe, although it may develop at term. The disease usually occurs after 20 weeks gestation, except in cases of hydatidiform mole or fetal hydrous[7].

Maternal death rates from preeclampsia have been significantly reduced by careful patient management in the developed world, but not in developing countries, which account for 99% of total annual global maternal death[5]. This disease is a special situation that occurs only in human pregnancy and presents with hypertension, proteinuria and with or without edema occurring after 20th weeks of gestation in previously normotensive and non-proteinuric women[5].

The main cause of preeclampsia is unknown; however abnormal placental implantation is thought to be responsible to an inflammatory type response with endothelial dysfunction. Different etiology have been known in preeclampsia include immunological factors, genetics, nutrition, oxidative stress or excessive lipid peroxidation, and imbalance of prostaglandin levels has been implicated in preeclampsia[9].

Early onset disease would be result of a poor early placentation and late onset preeclampsia is originated from exaggerated systemic inflammatory response such as predisposing cardiovascular or metabolic risks for endothelial dysfunction[5]. To detect preeclampsia a variety of quantities are measured at examination. Hemoglobin commonly measured during the pregnancy is one of the quantities[11]. In Bangladesh about 16% of maternal deaths are associated with preeclampsia and eclampsia[8].

With the above background this study undertaken to observe the serum hemoglobin levels to predict preeclampsia and monitoring the pregnant women and its regular measure in three trimesters help us to identify women at risk of preeclampsia.

Methodology

This cross-sectional study was carried out in the Department of Physiology at Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka, Bangladesh from July 2009 to June 2010. The study protocol was approved by the central ethical review committee of this university. For this, pregnant women of preeclampsia, age ranged from 18-39 years, >20th weeks of pregnancy were included in the study (group B). They were further divided into group B_1 which was consisting of 30 mild preeclamptic women and group B_2 which was consisting of 30 severe preeclamptic women. For comparison age and gestational period matched 30 normotensive pregnant women control (group A) were also studied. Both control (group A) and preeclamptic women were selected from Obstetric and Gynae in and out patient Department of BSMMU and Dhaka Medical College Hospital, Dhaka, Bangladeh. Subject with history of diabetes mellitus, renal, cardiovascular, liver disease, chronic hypertension, endocrine disorder, any chronic illness, hydatiform mole, malignancy, hemophilia were excluded from the study. After selection the the aim and benefit of the study was explained to each subject. When they agreed for participation a written informed consent was taken. Detailed family and medical history were taken. Thorough clinical examinations of all subjects were done and systolic and diastolic blood pressure was carefully recorded. All informations were recorded in a prefixed questionnaire .Then 5 ml of venous blood was collected from ante-cubital vein from aseptic precaution from each subject for estimation of hematological. Serum hemoglobin was estimated by Cyanmethemoglobin method, and was done in the laboratory of the Department of Physiology of BSMMU, Dhaka.

Statistical Analysis: Data were expressed as Mean±SD. Data analysis was done by SPSS Version 12. For statistical analysis ANOVA, independent sample t test, Chi square test test and Pearson's correlation coefficient test were used as applicable.

Results

In this study, all the groups were matched for age and gestational period but the mean BMI, SBP and DBP were significantly higher in group B_1 and B_2 ($p<0.001$) in comparison to that of group A. Again this value was significantly higher in B_2 than those of B_1 (Table 1).

Table 1: Age, BMI, Gestational period, SBP & DBP in different groups of Subjects (n=90)

Groups	n	Age in Years	BMI (kg/m^2)	Ges. Period (weeks)	SBP (mm of Hg)	DBP (mm of Hg)
A	30	25.13±4.97	23.22±1.88	31±4.39	108.17±8.95	68.67±8.19
B_1	30	24.63±5.70	25.05±2.13	32.67±0.64	144.33±6.79	94.50±4.01
B_2	30	25.60±5.70	26.63±2.50	32.03 ±0.45	166.67±10.28	113.17±5.79

SBP=Systolic blood pressure; DBP=Diastolic blood pressure; Group A = Normotensive pregnant women (control); Group B_1 = Mild preeclamptic women; Group B_2 = Severe preeclamptic women

Table 2: Comparison of Different Groups to calculate P value

Groups	P value				
A vs B_1 vs B_2	0.787^{ns}	0.000^{***}	0.237^{ns}	0.000^{***}	0.000^{***}
A vs B_1	0.680^{ns}	0.001^{***}	0.115^{ns}	0.000^{***}	0.000^{***}
A vs B_2	0.771^{ns}	0.000^{***}	0.295^{ns}	0.000^{***}	0.000^{***}
B_1 vs B_2	0.514^{ns}	0.01^{**}	0.510^{ns}	0.000^{***}	0.000^{***}

Data are expressed as Mean ± SD. For statistical analysis, one-way ANOVA was performed for comparison among the groups and independent sample t test was done for comparison between the groups. Figures in parentheses indicate ranges; ***= p≤0.001; ns= Non significant; ** = p≤0.01; n = Number of subjects

Table 3: Serum Hemoglobin Levels in Different Groups (n =90)

Groups	n	S. hemoglobin (gm/dL)
A	30	10.58±0.9 (9.2-12.6)
B_1	30	11.23±0.86 (9.9-13.2)
B_2	30	11.56±1.28 (9.2-13.9)

Data are expressed as Mean ± SD; Figures in parentheses indicate ranges; Group A = Normotensive pregnant women (control); Group B_1 = Mild preeclamptic women; Group B_2 = Severe preeclamptic women

Table 4: Comparison of Different Groups

Groups	p value
A vs B_1 vs B_2	0.001^{***}
A vs B_1	0.005^{**}
A vs B_2	0.001^{***}
B_1 vs B_2	0.242^{ns}

One-way ANOVA was performed to compare 3 groups; independent sample t test was done to compare 2 groups; ***= p≤0.001; ns= Non significant; **=p≤0.01; n = Number of subjects; *= p≤0.05

Mean serum hemoglobin levels were significantly ($p<0.001$) higher in both the study groups B_1 and B_2 in comparison to that of control group A. Again Hemoglobin levels were higher in group B_2 than B_1, but not significant (P>0.05) **(**Table 3 and Figure I).

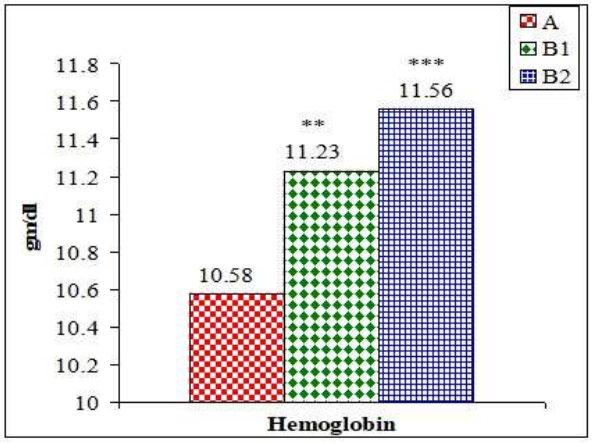

Figure I: Mean Hemoglobin Levels In Different Groups (n=90); Group A=Normotensive pregnant women (control); Group B_1=Mild preeclamptic women; Group B_2=Severe preeclamptic women

Again serum hemoglobin was positively correlated with SBP and DBP in group A, B_1 and B_2 which was statistically not significant.

Table 5: Correlations of Serum Hemoglobin with SBP and DBP in Different Groups (n=90)

Parameters	Group A		Group B_1		Group B_2	
	r	P value	r	P value	r	P value
Hemoglobin	+ 0.190	0.314^{ns}	+0.182	0.336^{ns}	+ 0.171	0.366^{ns}
hemoglobin	+ 0.043	0.822^{ns}	+ 0.134	0.481^{ns}	+ 0.120	0.529^{ns}

Pearson's correlation coefficient (r) test was performed as the test of significance; Group A = Normotensive pregnant women (control group); Group B_1 = Mild preeclamptic women; Group B_2 = Severe preeclamptic women; ns = Non significant

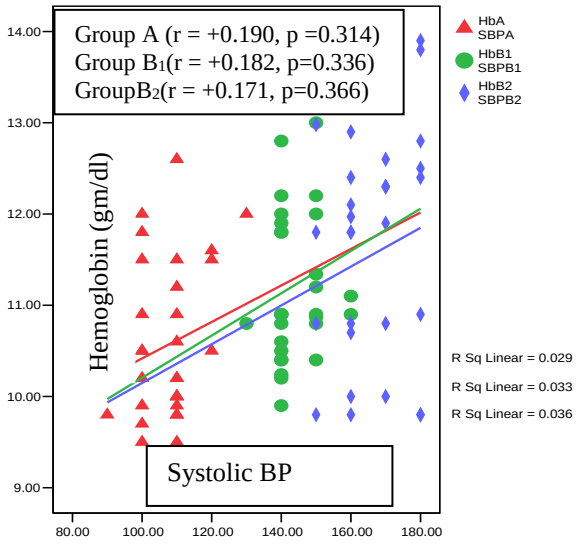

Figure II: Correlation of hemoglobin with systolic blood pressure in different groups (n=90); Statistical analysis was done by Pearson's correlation-coefficient (r) test; Group A=Normotensive pregnant women (control); Group B_1=Mild preeclamptic women; Group B_2 = Severe preeclamptic women

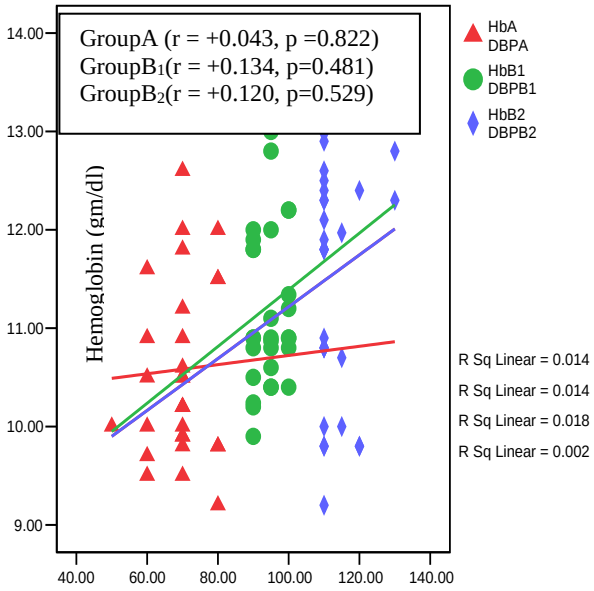

Figure III: Correlation of hemoglobin with diastolic blood pressure in different groups (n=90) Statistical analysis was done by Pearson's correlation-coefficient (r) test; Group A = Normotensive pregnant women (control); Group B_1 = Mild preeclamptic women; Group B_2 = Severe preeclamptic women

Discussion

Quality of life for mother and newborn has become our most important concern now a day[10]. Pre eclampsia is still one of the leading causes of maternal and fetal morbidity and mortality. Despite active research for many decades, the etiology of this disorder remains exclusive to human pregnancy is an enigma. Many hypotheses have been offered and include prostacyclin thromboxane imbalance, endothelial dysfunction and immunogenetic and absolute or relative placental ischemia. The current study is undertaken to evaluate hemoglobin status in pre eclampsia[1].

This study observed significantly higher hemoglobin level in preeclamptic women than normotensive pregnant woman. Similar observation were also reported of Sagen et al[14]; Kumru et al[13]; Helimann et al[15]. Again there was no significant ($p>0.05$) difference in hemoglobin levels between two preeclamptic groups. However, no published data was found to compare these findings. Hemoglobin concentration showed positive correlation with systolic and diastolic blood pressure in all groups which were statistically non-significant ($p>0.05$). Again in the present study, preeclamptic women showed significantly higher value of hemoglobin concentration which may be the results of haemoconcentration. In general, there appears to be an agreement that higher maternal Hb levels at different stages of pregnancy increase the risk of PE. Our finding shows that there was a significant relation between high maternal hemoglobin and preeclampsis. It may be explained by a generalized vasoconstriction and abnormal endothelial cell function. Sarrel et al[9] suggested that an increase hemoglobin concentration was the cause of vasoconstriction in preeclampsia.

High hemoglobin concentration might affect growth in the development of preeclampsia. Failure of the plasma volume to expand and poor placental flow is associated with the incidence of preeclampsia[9]. The mechanism for the observed higher hemoglobin concentration is the failure of normal plasma expansion; hypovolemia and poor placental perfusion are all part of physiological disturbance of preeclampsia. In preeclampsia, the loss of serum protein and the increase in capillary endothelial permeability led to a decrease in intravascular volume and increase tissue oedema[10].

The mechanism underlying the contribution of hemoglobin to PE may primarily involve high blood viscosity. Hyperviscosity can directly reduce blood flow in low kinetic force microvasculature such as the placenta. This may lead to reduced perfusion and oxygenation of placental tissue hypoxia as a direct result of low velocity placental circulation and reduced oxygen supply[12].

Moreover hemoglobin has a direct role in nitric oxide (NO) regulation and endothelial function, NO is a potent vasodilator and can relax vascular smooth muscle cells. Free hemoglobin can bind and inactive NO, thus leading to vasoconstriction with consequent hypertension and placental ischemia[12]. Furthermore, oxidized hemoglobin could create

methemoglobin derived heme deposits on the vascular endothelium, which in turn directly damage the endothelium[12].

The decrease in blood volume could lead to an increase in maternal hemoglobin concentration. Measuring the rate of hemoglobin in the first visit of pregnant women is performed in all cases in routine form. This method could be beneficial for recognizing mother who was exposed to danger and prevent the complications associated.

Conclusion

By considering that High maternal hemoglobin is one of the risk factor for preeclampsia. Therefore, hemoglobin estimation has to be done during each antenatal checkup may reduce the incidence of preeclampsia.

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