

A Study of Platelet Count and Mean Platelet Volume in Newborn of Preeclamptic Mother

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Abstract

Introduction: Pregnancy is a physiological process. Preeclampsia is the commonest complication during pregnancy. This condition might severely affect the health of mothers and their newborns. Newborn of mothers with preeclampsia are more liable for intrauterine growth retardation and may be delivered prematurely. **Aim of the Study:** The aim of this study was to evaluate the platelet count and mean platelet volume in newborn of preeclamptic mother. **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 Platelet count and mean platelet volume. 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:** The mean (\pm SD) platelet count was $164.77 \pm 79.44 \times 10^3/\mu\text{l}$ and $212.83 \pm 54.04 \times 10^3/\mu\text{l}$ in group A and B respectively. In this study, the mean (\pm SD) platelet count was lower in group A in comparison to that of group B which was statistically significant ($p < 0.001$). The mean (\pm SD) platelet volume was 8.90 ± 1.15 fl and 8.30 ± 1.45 fl in group A and B respectively. In this study, the mean (\pm SD) platelet volume was higher in group A in comparison to that of group B which was not statistically significant. Maternal systolic blood pressure showed negative correlation (- 0.952) with platelet count of newborn in preeclamptic mother, which was statistically significant ($p < 0.001$). Maternal diastolic blood pressure showed negative correlation (- 0.960) with platelet count of newborn in preeclamptic mother, which was statistically significant ($p < 0.001$). Maternal systolic blood pressure showed negative correlation (-0.973) with mean platelet volume of newborn in preeclamptic mother, which was not statistically significant ($p > 0.05$). Maternal diastolic blood pressure showed negative correlation (- 0.964) with mean platelet volume of newborn in preeclamptic mother, which was not statistically significant ($p > 0.05$). **Conclusion:** From the findings of the study, it can be concluded that the platelet count of newborn of preeclamptic mother was significantly lower in comparison to newborn of healthy pregnant mother but they were within normal range. This difference was significantly related to severity of maternal blood pressure. But there was no statistically significant difference in mean platelet volume between the groups. There was no statistically significant relation of mean platelet volume to maternal blood pressure.

Keywords: Platelet Count, Mean Platelet Volume, Newborn of Preeclamptic Mother.

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I. INTRODUCTION

Preeclampsia is a condition with unknown etiology characterized by the manifestation of new onset of hypertension during pregnancy with proteinuria, and/or edema. Preterm delivery and low birth weight regarded as major risk factors for many ailments [1]. Mediators that enter circulation as a result of reduced placental perfusion harm endothelial cells and interfere with their normal activities because the trophoblastic invasion of the maternal arteries is impaired. This circumstance is thought to be the primary cause of this clinical disorder [2]. An increase in platelet aggregation has been noted in normal pregnancies, which is countered by increased platelet volume and synthesis [3]. The sensitivity of changes in platelet volume was shown to be higher than differences in platelet number in the evaluation of the platelet functions during a normal pregnancy [4]. Changes in blood circulation, endothelial cell injury, platelet activation, and enhanced intravenous thrombin production are the main pathophysiological processes in preeclampsia [5]. Additionally, there is published research demonstrating changes in platelet volume, quantity, and function, which are connected to the activation of the maternal vascular system [6, 7]. Numerous studies have shown that the total platelet count was much lower in preeclamptic mothers' newborns than it was in mothers who were healthy during pregnancy [8, 9]. Neonatal thrombocytopenia was observed in 47% newborn of preeclamptic mother which led to serious complications like sepsis and bleeding tendencies including intracranial hemorrhage [10]. However, Burrows and Andrew [11] found no appreciable decrease in the platelet count of term babies delivered to preeclamptic mothers in their investigation. Studies have also suggested that platelets have a significant impact on the etiology of preeclampsia [12, 13]. There are many studies on platelet indices in preeclampsia in pregnant women and it has been suggested that these parameters have a prognostic significance in determining the severity of preeclampsia [14]. Conversely, there are some studies suggesting that whole blood platelet aggregation fails to detect differences between preeclampsia and normal pregnancy [15]. Mean platelet volume (MPV), a readily available marker of platelet activation, is used in the assessment of prothrombotic and pro-inflammatory potentials in several clinical conditions [16]. Although the origin of newborn neutropenia and thrombocytopenia in preeclampsia is uncertain, it is believed that placental insufficiency is to blame for the reduced leukocyte and platelet production [11, 17, 18]. Early thrombocytopenia is more common in placental deficiency brought on by hypertension in newborns of preeclamptic mothers [19]. When platelets come into contact with damaged endothelium, the coagulation system is activated, increasing both platelet production and consumption [20]. Multisystem dysfunction occurs in PE as a result of activation of the coagulation system

and increased platelet aggregation [21, 22]. Thrombocytopenia is a significant indicator of PE and is brought on by the increased platelet consumption brought on by the aberrant coagulation system and platelet activation [20, 23]. During platelet activation, the quantity and size of pseudopodia increases which is a sign of platelet size, function, and activity [24]. As a result of the increased platelet consumption, the bone marrow had to create and release more immature and big platelets which raise MPV in PE patients [20, 25-27]. There are very few studies about the platelet count and mean platelet volume in newborn of preeclamptic mother. Thus, the current study was conducted to evaluate the platelet count and mean platelet volume in newborn of preeclamptic mother.

II. OBJECTIVES

- To evaluate the platelet count and mean platelet volume in newborn of preeclamptic mother.

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 for platelet count and mean platelet volume 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. 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 [28].

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 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) 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 multi 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. 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, both the groups were matched for sex. Mean (\pm SD) birth weight of the newborn of the study group A and control group B were 2.42 ± 0.39 and 2.95 ± 0.22 kg respectively. There was statistically significant ($p < 0.001$) differences between the groups. 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. 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 total count of platelet was shown in Table II and Figure 1. The mean (\pm SD) platelet count was $164.77 \pm 79.44 \times 10^3/\mu\text{l}$ and $212.83 \pm 54.04 \times 10^3/\mu\text{l}$ in group A and B respectively. In this study, the mean (\pm SD) platelet count was lower in group A in comparison to that of group B which was statistically significant ($p < 0.001$). The mean platelet volume was shown in Table II and Figure 2. The mean (\pm SD) platelet volume was 8.90 ± 1.15 fl and 8.30 ± 1.45 fl in group A and B respectively. In this study, the mean (\pm SD) platelet volume was higher in group A in comparison to that of group B which was not statistically significant. The correlation of platelet counts with systolic and diastolic blood pressure in study groups was demonstrated in figure 3. Maternal systolic blood pressure showed negative correlation (-0.952) with platelet count of newborn in preeclamptic mother, which was statistically significant ($p < 0.001$). Maternal diastolic blood pressure showed negative correlation (-0.960) with platelet count of newborn in preeclamptic mother, which was statistically significant ($p < 0.001$). The correlation of mean platelet volume with systolic and diastolic blood pressure in study groups was demonstrated in figure 4. Maternal systolic blood pressure showed negative correlation (-0.973) with mean platelet volume of newborn in preeclamptic mother, which was not statistically significant ($p > 0.05$). Maternal diastolic blood pressure showed negative correlation (-0.964) with mean platelet volume of newborn in preeclamptic mother, which was not statistically significant ($p > 0.05$).

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 ± 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 ± 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%)	
Birth weight (kg)	Mean ± SD	2.42±0.39	2.95±0.22	<0.001***
Systolic BP of mother ^a (mmHg)	Mean ± SD	173 ± 19.73	114.83 ± 11.72	<0.001***
Diastolic BP of mother ^a (mmHg)	Mean ± SD	108.33 ± 9.52	73.33 ± 9.07	<0.001***

Results were expressed as mean ± 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)	
Platelet count (×10 ³ / μl) ^a	164.77 ± 79.44	212.83 ± 54.04	<0.001***
Mean Platelet Volume (fl)	8.90±1.15	8.30±1.45	0.0810 ^{ns}

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.

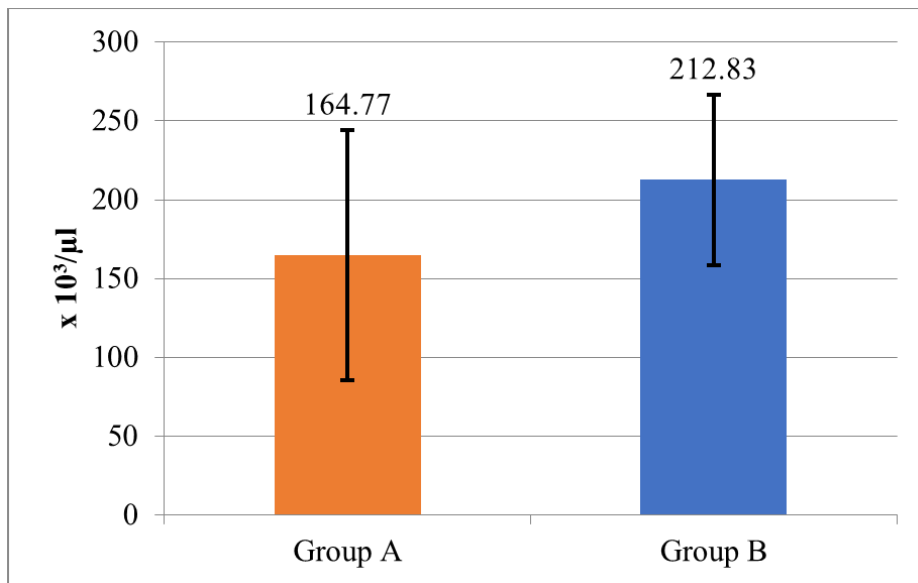


Figure 1: Mean total count of platelet in both groups (N=60)

Group A: Newborns of preeclamptic mother; Group B: Newborns of healthy mother; N= total number of subjects

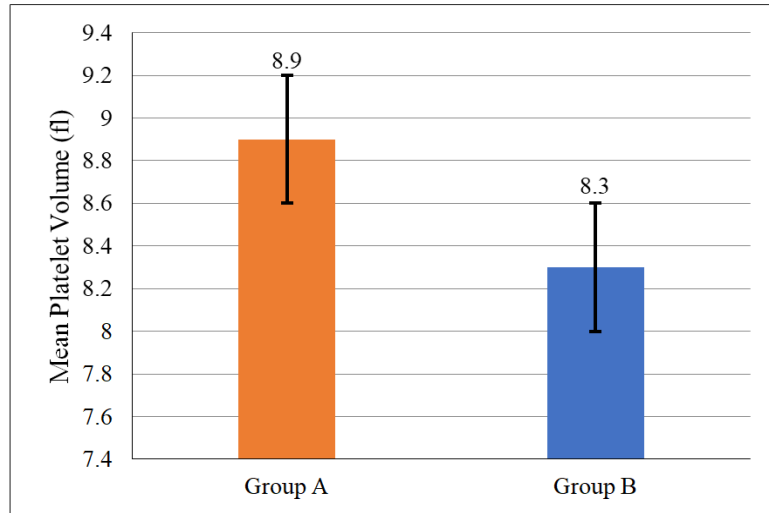


Figure 2: Mean platelet volume in both groups (N=60)

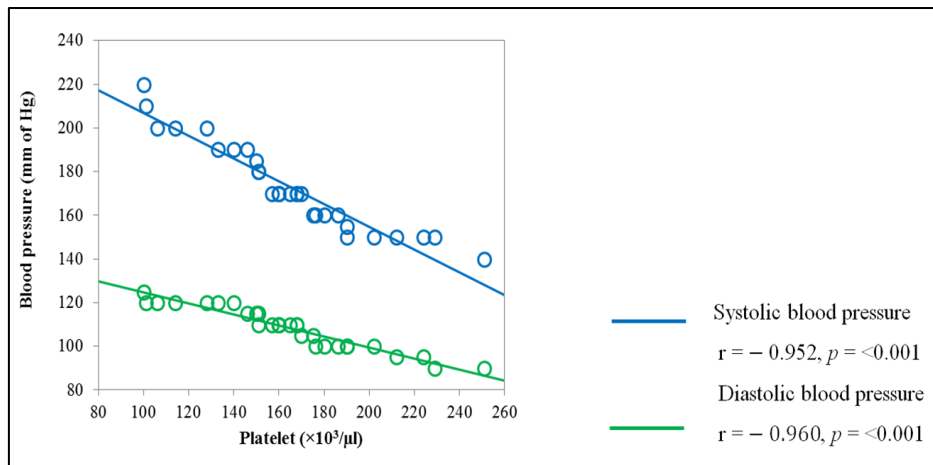


Figure 3: Correlation of platelet counts with systolic and diastolic blood pressure in study group (n=30)
 n = number of subjects in study group; Study subjects: Newborns of preeclamptic mother

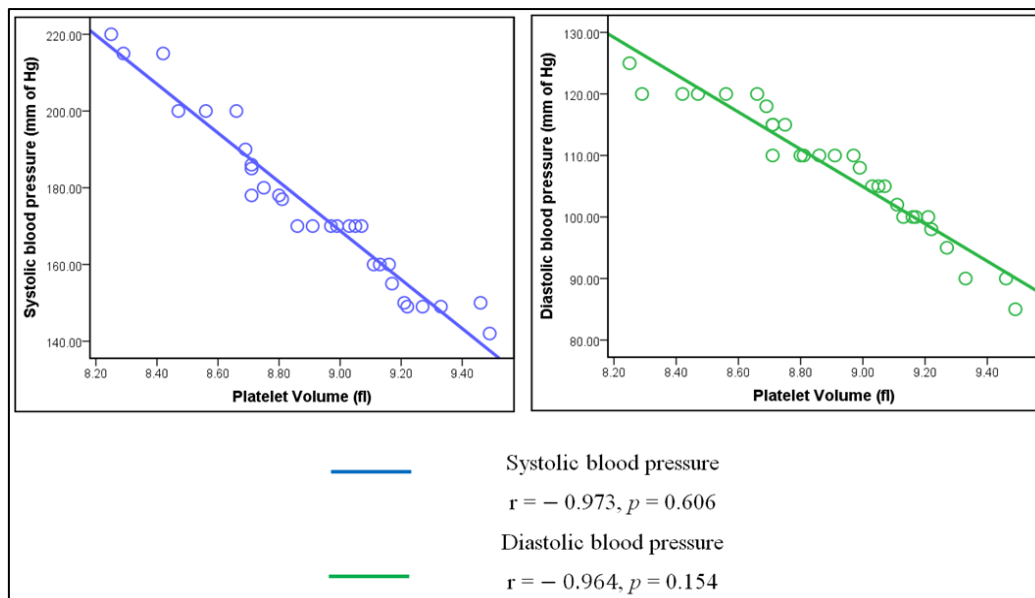


Figure 4: Correlation of Mean platelet volume with systolic and diastolic blood pressure in study group (n=30)
 n = number of subjects in study group; Study subjects: Newborns of preeclamptic mother

V. DISCUSSION

In the present study, the platelet count was significantly (<0.001) lower in newborns of preeclamptic mothers than that of newborns of healthy pregnant women. Similar types of observations were found by some researchers of different countries [8, 29-32]. In a study, Burrows and Andrew [11] divided the newborn of preeclamptic mother into term and preterm groups. They observed no significant change of platelet count in term newborns of preeclamptic mother. This disagreement in findings might have occurred due to evaluation of platelet count separately in term and preterm newborn of preeclamptic mothers. Whereas, in my study, platelet count of newborn cord blood of preeclamptic mothers was evaluated in a single group where both term and preterm newborns were included. In this current study, platelet counts and MPV showed negative correlation with severity maternal blood pressure. Similar type of observations was found by different researchers [8, 29, 31, 33]. Some researchers found significant negative correlation between platelet count of newborn of preeclamptic mother with severity of maternal blood pressure, but no correlation was found with other blood parameters [8, 29, 33]. This dissimilarity in findings might have occurred due to different methodology. In established preeclampsia, changes in the coagulation system leads to a decrease in platelet count, which suggests an early sign of the disease [34, 35]. Moreover, the progression of preeclampsia to the severe stage leads to increased turnover of platelet [36]. In this study, the mean (\pm SD) platelet volume was higher in group A in comparison to that of group B but there was no statistically significant difference. In the study of KAVURT AS *et al.*, [37] the MPV was almost similar in both groups with no statistically significant differences ($p=0.735$). This finding is similar to our study. But in another study of SELÇUK SN *et al.*, [38], the infants of mothers with preeclampsia had significantly elevated MPV ($p<0.0001$). MPV is measured during the complete blood count as an indicator of platelet size; it is indirect measurement of platelet activation. Previous studies reported increased MPV levels in preeclampsia but the mechanism is not clear [13, 20] [39, 40]. Endothelial damage is considered as the primary reason. Investigations about MPV levels in preeclampsia have hypothesized that increased MPV levels might be a consequence deterioration of microcirculation because of endothelial damage, this causes microthrombi formation and increases platelet turnover, so younger thrombocytes enter the circulation [20, 21] [40, 41]. However, these results are insufficient to conclude an exact association. Various studies found statistically significant correlation between the newborn's platelet count and severity of maternal hypertension was not obtained though the number of babies born to HDP mothers with thrombocytopenia was higher [42, 43]. Although the exact pathophysiologic mechanism is not known, it was reported that utero-placental

insufficiency secondary to pregnancy induced hypertension is responsible for the development of thrombocytopenia [44]. Bleeding in neonates occurs if the platelet count decrease to $<50,000/\text{mm}^3$ [45]. The study of Kleckner *et al.*, [46] reported that cause of this thrombocytopenia was thrombocyte destruction due to platelet adherence to abnormal placental endothelium. But study of Burrow *et al.*, [11] reported that there was no significant change in total platelet count in term babies of hypertensive mothers and normotensive mothers. Moodley *et al.*, [47] suggested about an undefined factor which may cause disseminated intravascular coagulation (DIC). This factor transported by the placenta and caused thrombocytopenia in the neonates. Akcan *et al.*, [48] suggested the role of mediators in developing thrombocytopenia. Vascular endothelial growth factor (VEGF) and placental growth factor (PIGF) are responsible for maturation of megakaryocyte and participate in the regulation of megakaryocyte development [49]. The activity of these two factors is suppressed by sFlt 1 and soluble Enderlin, which are found to be raised in pre-eclampsia pregnancies. Platelet counts are more affected in neonates of eclamptic and pre-eclampsia mothers than in mothers with gestational hypertension, suggesting that the severity as well as the duration of hypertension is important in influencing the platelets of neonates born to HDP mothers and eventually the final neonatal and perinatal outcome [50, 51].

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.

VII. CONCLUSION AND RECOMMENDATIONS

From the findings of the study, it can be concluded that the platelet count of newborn of preeclamptic mother was significantly lower in comparison to newborn of healthy pregnant mother but they were within normal range. This difference was significantly related to severity of maternal blood pressure. But there was no statistically significant difference in mean platelet volume between the groups. There was no statistically significant relation of mean platelet count to maternal blood pressure. 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. 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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