Immunol Genet J, Vol. 5, No. 4, December 2022, pp.149-153 **DOI: https://doi.org/10.18502/igj.v5i4.16179**

Original Article

Hematological and Coagulation Factors in Term and Preterm Newborns of Mothers with Pre-eclampsia

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Received: 05 August 2022; Accepted: 12 October 2022

Abstract

Objective: Pre-eclampsia (preE) is pregnancy-induced hypertension affecting a significant proportion of pregnant women worldwide and can cause detrimental effects on the mother and newborn. Recognition of contributing factors of health in neonates with pre-eclamptic mothers is important to reduce the burden of the problem. The aim of the study was to determine the hematologic and coagulation factors in term and preterm neonates born to mothers with pre-eclampsia.

Method and Materials: In this observational cross-sectional comparative study, 104 neonates born to mothers with pre-eclampsia in Imam-Hossein Hospital from 2018 to 2021 were enrolled. The neonates were divided into term and preterm groups according to the gestational age of the mothers. Maternal and fetal parameters of neonates were collected. The hematologic and coagulation factors were recorded and compared.

Results: The finding of the study demonstrated that the mean leukocyte (P=0.030), hemoglobin (P=0.0001), and platelet (P=0.0001) were significantly higher in term neonates. The mean PT (P=0.003), PPT (P=0.001), and INR (P=0.003) were significantly higher in preterm cases.

Conclusion: Totally, according to the obtained results it may be concluded that CBC indexes and coagulopathy in term and preterm neonates born to mothers with pre-eclampsia are significantly different.

Keywords: Pre-eclampsia; Neonatal; Preterm; Hematologic Factors.

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How to cite this article
Barzamini S, Barzamini R, Taslimi Taleghani N. Hematological and Coagulation Factors in Term and Preterm Newborns of Mothers with Pre-eclampsia. Immunology and Genetics Journal, 2022; 5(4): 149-153. DOI: https://doi.org/10.18502/igj.v5i4.16179

Introduction

Pre-eclampsia (PreE) is pregnancy-induced hypertension affecting a significant proportion of pregnant women worldwide and can cause detrimental effects on the mother and newborn(1). Hypertensive disorders during pregnancy are associated with high maternofetal mortality and morbidity in both underdeveloped and developed countries(2). The disease is determined by high blood pressure and proteinuria in pregnant women and is often associated with several fetal and neonatal complications such as fetal distress, fetal death, growth restriction, oligohydramnios, low APGAR scores, and intrauterine growth restriction (IUGR) (3, 4). PreE is diagnosed based on systolic blood pressure (BP) of 140 mm Hg or higher or diastolic blood pressure of 90 mm Hg or higher with proteinuria of 0.3 g or more in a 24-hour urine sample(1).

According to studies, neonates of hypertensive women, especially those with pre-eclampsia, are more prone to hematological permutation. The etiology and pathogenesis of pre-eclampsia are not fully understood, but a proinflammatory immune state prevails and can impair fetal hematopoiesis. Some of the effects on neonates include neutropenia, neonatal thrombocytopenia, decreased regulatory T cells, and increased cytotoxic natural killer cell profiles (5-7). There are no established international guidelines for the routine screening of infants born to women with pre-eclampsia(8).

Hypertension disorders during pregnancy cause an increase in mortality and morbidity in both mother and neonate, and therefore timely diagnosis and treatment of these disorders are of particular importance; because even the problems caused by these disorders continue in the postpartum period, and mothers are monitored in this regard until about 6 weeks after delivery(9). There have been many studies on pre-eclampsia diagnostic tests, but currently, there is no reliable, valid, and economical screening test for pre-eclampsia. There have been many studies on pre-eclampsia diagnostic tests, but currently, there is no reliable, valid, and economical screening test for pre-eclampsia. Pre-eclampsia can be diagnosed in the early stages only with planned prenatal care. There are many contradictions regarding the need to evaluate blood cells, especially leukocytes, and coagulation tests in babies born to mothers with pre-eclampsia. Hence, we aimed to evaluate the hematological and coagulation factors in term and pre-term infants born to mothers with pre-eclampsia in Imam Hossein Hospital.

Methods and Materials

This descriptive-cross-sectional study was conducted at Imam Hossein Hospital in Tehran, Iran between 2018 and 2021. In this study, 104 term and preterm infants born to mothers with pre-eclampsia were enrolled to study. The inclusion criteria were pregnancy older than 20 weeks gestation. Exclusion criteria were neonates with major anomalies, babies with severe birth asphyxia, and other hospitalized neonates. Pre-eclampsia is defined as a) hypertension with proteinuria (systolic pressure elevated >140 mmHg and diastolic pressure >90 mm Hg appearing for the first time after 20 weeks of gestation and b) proteinuria alone (>300 mg/24 hour). The neonates were divided into term and preterm groups according to the gestational age of the mothers. Maternal and fetal parameters of neonates were collected. Hematologic and coagulation factors were compared between the two groups. The study was conducted according to the principles of Helsinki and was approved by the research ethical committee of Shahid Beheshti University of Medical Sciences, Iran. Written consents were obtained from the women with pre-eclampsia.

Statistical analysis

Statistical analysis was performed by SPSS software version 22 (IBM, Chicago, USA). The quantitative and qualitative variables were indicated as mean±SD and number (percentage), respectively. Kolmogorov–Smirnov and Shapiro–Wilk tests were used to test for the distribution. Differences were compared by using the chi-square/Fisher's exact tests as appropriate. A P-value less than 0.05 was considered statistically significant.

Results

Of the 104 neonates studied, 33.7% (35 neonates) were preterm. The gestational age of pre-eclampsia was significantly different in both groups(P=0.002). **Table 1** shows the comparison of maternal and fetal parameters in premature and term neonates.

Table 1. Comparison of maternal and fetal parameters between preterm and term neonates

Variable	Preterm neonates (n=35)	Term neonates (n=69)	*P*-value
Gestational age of preeclampsia (Weeks)	30.8±1.8	32.1±1.9	**0.002**
Gestational age of previous preeclampsia (Weeks)	34.0±0	33.2±1.4	**>0.05**
Maternal history of preeclampsia(n, %)	6 (17.6%)	17(25%)	**>0.05**
Severe preeclampsia(n, %)	20 (57.1%)	4 (5.8%)	**0.0001**
Male gender (n, %)	19 (54.3%)	40 (58%)	**>0.05**
Cesarean delivery (n, %)	27 (77.1%)	23 (33.3%)	**0.0001**
Systolic blood pressure (mmHg)	154.1±13.8	141.1±6.6	**0.0001**
Diastolic blood pressure(mmHg)	98.1±18.1	83.9±8.8	**0.0001**
First birth order (n, %)	33 (94.3%)	65 (94.2%)	**>0.05**
History of infertility(n, %)	3 (8.6%)	4 (5.8%)	**>0.05**
Gestational hypertension(n, %)	-	65 (95.6%)	**>0.05**
Intrauterine growth restriction (IUGR)	19 (54.3%)	14 (20.3%)	**0.0001**

Table 2 shows the hematologic and coagulation factors in the preterm and term groups. The level of leukocytes was significantly higher in the term neonates group (P=0.030). Also, platelets and hemoglobin were significantly different between the two groups (P=0.0001). A significant difference was observed in terms of coagulation factors between the two groups.

Table 2. Hematologic and coagulation factors in two groups

Variable	Preterm neonates	Term neonates	*P*-value
Leukocyte	12191.4±3510.02	13646.4±3006.05	**0.030**
Neutrophil	31.51±6.98	33.12±7.97	**>0.05**
Lymphocyte (%)	64.97±6.69	63.2±8.35	**>0.05**
Hemoglobin (g/dl)	13.2±1.29	14.7±1.53	**0.0001**
Platelet (10^9/L)	138.6±27.11	189.0±30.85	**0.0001**
Prothrombin Time (PT) (S)	16.9±2.55	15.52±1.61	**0.003**
Partial Thromboplastin Time (PTT) (S)	39.9±4.75	36.3±4.95	**0.001**
International Normalized Ratio (INR)	1.3±0.23	1.2±0.23	**0.003**

Discussion

Pre-eclampsia is one of the important causes of death and complications of maternal and neonatal(3). High blood pressure during pregnancy has a direct effect on the newborn. One of these complications is a variation in the homeotic system and coagulation profile, which exposes infants to the risk of bleeding and increased susceptibility to infection due to a decrease in the number of platelets and disruption of the coagulation profile(3, 10, 11). One of these factors is the alternation in hematological factors that may cause an increase in complications in infants. A remarkable increase in leukocyte level, hemoglobin, and platelet count was observed in term neonates compared to the preterm group.

Placenta implantation with abnormal trophoblastic invasion of uterine vessels is one of the

main causes of high blood pressure along with pre-eclampsia syndrome. The degree of incomplete trophoblastic invasion in spiral vessels is directly related to the severity of subsequent hypertension in the mother. because the decrease in blood supply to the placenta, which is caused by an incomplete invasion with an unknown route, leads to the release of systemic vasoactive compounds that cause the exacerbation of the inflammatory response, vasoconstriction, damage to the endothelium, capillary leakage, coagulation problems and disorders in the function of platelets, and all of them are involved in the occurrence of defects in organ function and play a fundamental role in the clinical manifestations of pre-eclampsia(1, 12, 13).

Thrombocytopenia could occur as a result of thrombocyte adherence to the damaged endothelial region caused by segmental vasospasm and vasodilatation in the placenta of maternal Pre-eclampsia(14).

Similar to our results, the level of platelets in the term was significantly higher than in the preterm group. El Sayed et al. reported that prothrombin time and partial thromboplastin time were significantly different in the term group compared to preterm neonates. The result of El Sayed's study is similar to the findings of our study. Mosayebi et al. reported that PT and PTT were abnormally prolonged in preterm neonates(15).

Based on our findings, the level of hemoglobin was significantly higher in the term neonates. Contrary to our results, in El Sayed's study, no notable difference was observed between the two groups in terms of hemoglobin. The reason for these contradictions may be the different sample sizes. According to our results, there was no significant difference between the term and preterm groups in terms of neutrophils and lymphocytes. In the Bayoumi study, no statistically significant difference was found between case and control subjects in the number of white blood cells (WBC) and absolute neutrophil count (ANC)(8). Balot et al. reported no significant alternation in neutrophil count(16), which is in line with the result of our study. Our study had several limitations. Our study had several limitations. First, the sample size was small. Second, the lack of a control group was pointed out.

Conclusion

The results of the present study showed that there is a significant difference in CBC indices and coagulation factors in term and preterm infants born to mothers with pre-eclampsia. It has been proven that the premature baby is affected more than term. All these findings require prenatal care and resuscitation facilities and careful follow-up of the blood and coagulation status of the group of premature neonates.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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