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The Importance and Evaluation of Mean Platelet Volume on the Severity of Preeclampsia

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Abstract

Objective: The aim of this study was to determine the correlation between thrombocytes volume and severity of the disease on pregnants who diagnosed mild, severe preeclampsia or eclampsia.

Methods: In this study 58 pregnants whose ages between 17 and 41 and past 28th week of delivery were included in this study. Twenty healthy pregnants were in control group (Group K) and 38 preeclamptic pregnants were in study group. Study group was separated into two groups as 20 mild preeclamptic pregnants (Group H) and 18 severe preeclamptic pregnants (Group A). Furthermore, thrombocyte counts were separated into 3 groups as <100,000/mm^3 (Group 1), 100,000-150,000/mm^3 (Group 2), >150,000/mm^3 (Group 3) and association between thrombocyte volumes and thrombocyte counts were determined. Complete cell count was viewed for two times at 3rd trimester and 6 weeks after delivery and mean thrombocyte volumes and thrombocyte counts were recorded at this time. Association between mean thrombocyte volumes on severity of preeclampsia and thrombocyte counts was examined. Demographic characteristics, number of births, week of pregnancy, birth weight, type of delivery and fetal biometric measurements were recorded.

Results: Prenatal and postnatal mean thrombocyte volumes of Group A was found higher than Group H and Group K. Comparison of prenatal and postnatal mean thrombocyte volumes of Group K and Group H were found insignificant. Prenatal thrombocyte counts were separated into three groups as <100,000/mm^3 (Group 1), 100,000-150,000/mm^3 (Group 2), >150,000/mm^3 (Group 3), mean thrombocyte volumes of groups were calculated 10.11±0.72 fl (femtoliter), 18±0.48 fl, 7.82±0.53 fl, respectively. According to MPV values, comparison between 2. group and 3. group were found insignificant, however comparison between 1. group and 2. group with 3. group were found significant. As a result of these examinations, mean thrombocyte volume was increasing if the clinical situation was gone worse and thrombocyte count was dropped.

Conclusion: Nearby prognostic factors, MPV values may be useful for seriousness of preeclampsia. But if the literature is examined, increased MPV values are found at normal pregnancies. These parameters can be useful for Preeclampsia follow up but more studies is needed.

Keywords: Preeclampsia, mean platelet volume, thrombocytes.

Preeklampsinin şiddetini öngörmede trombosit volüm ölçümlerinin değerlendirilmesi ve önemi

Amaç: Bu çalışmanın amacı; preeklampsi tanısı ile takip edilen gebelerde trombosit volüm ölçümlerinin hastalığın şiddeti ile olan ilişkisini araştırmaktır.

Yöntem: Bu çalışmaya, yaşları 17 ile 41 arasında, 28. haftayı doldurmuş, 58 gebe dahil edildi. Kontrol grubunda (Grup K) sağlıklı gebelerden oluşan 20 olgu, çalışma grubunda preeklamptik gebelerden oluşan 38 olgu vardı. Çalışma grubu; 20 hafif preeklamptik (Grup H) ve 18 ağır preeklamptik (Grup A) gebe içeren 2 gruba ayrıldı. Ayrıca trombosit sayıları da, <100,000/mm^3 (1. Grup), 100,000-150,000/mm^3 (2. Grup), >150,000/mm^3 (3. Grup) şeklinde üç gruba ayrıldı ve ortalama trombosit hacim değerlerinin trombosit sayılarıyla ilişkisi araştırıldı. Çalışmaya dahil edilen tüm gebelerde, 3. trimesterde ve doğumdan 6 hafta sonra olmak üzere iki kez hemogram çalışılarak, ortalama trombosit hacim değerleri ve trombosit sayıları kaydedildi. Ortalama trombosit hacmi değerinin, preeklamp-

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sinin şiddeti ve trombosit sayısı ile arasındaki ilişki incelendi. Hastaların demografik özellikleri, doğum sayısı, doğum haftası, yenidoğan ağırlığı, doğum şekli ve fetal biyometrik ölçümleri kayıt edildi.

Bulgular: Grup A'da ortalama trombosit hacim değerleri hem doğum öncesi hem de doğum sonrası, Grup H ve Grup K'ya göre daha yüksek izlendi. Grup K ve Grup H arasında ise hem doğum öncesi hem de doğum sonrası bakılan ortalama trombosit hacim değerleri arasında fark izlenmedi. Doğum öncesindeki trombosit değerleri, <100,000/mm^3 (1. Grup), 100,000-150,000/mm^3 (2. Grup) ve >150,000/mm^3 (3. Grup) olarak 3 gruba ayrıldı, grupların ortalama trombosit hacim değerleri sırasıyla 10.11±0.72 fl (femtolitre), 9.18±0.48 fl, 7.82±0.53 fl olarak hesaplandı. MPV değerleri açısından, 2., Grup ile 3., Grup arasında anlamlı fark izlenmezken, 1. Grup ile 2. ve 3. Grup arasında anlamlı fark izlendi. Bu incelemeler sonucunda trombosit sayısı düştükçe ve klinik tablo ağırlaştıkça ortalama trombosit hacim değerinin yüksek olduğu izlendi.

Sonuç: Preeklampsi takip sürecinde kanıtlanmış prognostik faktörlerin yanında birde ortalama trombosit hacim değerinin kullanılması tablonun ciddiyetini takip etmede faydalı olabilir. Ancak literatür incelendiğinde yüksek ortalama trombosit hacim değerlerinin normal gebeliklerde de izlenebileceği unutulmamalıdır. Bu parametrenin preeklampsinin takip sürecinde tam olarak yer edinebilmesi için daha kapsamlı çalışmalara ihtiyaç olmaktadır.

Anahtar Sözcükler: Preeklampsi, ortalama platelet hacmi, trombositler.

Introduction

Hypertensive disorders are the most medical complications of pregnancies and its incidence is reported at 5-10%. It is seen at healthy nulliparous women with a range of 2-7%. Physiopathology of this situation that creates a threat to fetomaternal health is not clearly known. Many theories have been suggested to explain physiopathology. But many of these are not proved yet. There are some theories that are still under consideration as, abnormal trophoblastic invasion, coagulation abnormalities, vascular endothelial injury, cardiovascular maladaptation, immunological disorders, genetic predisposition.[1] It is known that endothelial injury cause increased thrombocyte activation and platelet consumption by creating microthrombosis. In this process, megakaryocytes at bone marrow release thrombocytes which have a larger volume and more active, to compensate the platelet consumption. In this study, we aimed to determine the association between MPV values of preeclamptic pregnants and severity of the clinical signs.

Methods

58 pregnants who completed 28 weeks of pregnancy and referred to Ministry of Health Göztepe Education Training and Research Hospital, Gynecology and Obstetrics Clinic since October 2009 to May 2010 was included in this study. 20 of them were healthy (Group K), 20 of them were mild preeclampsia (Group H) and 18 of them were severe preeclampsia (Group A). Information about the study was given to all pregnants and their approvals were obtained.

Ethics committee permission was taken for the study.

Pregnants whose AP (arterial pressure) ≥140/90 mmHg at least 2 times and in 6 hours period, and ≥1+ proteinuria at two urinary samples were diagnosed as preeclampsia. AP was measured at sitting position and at the right arm, and the arm was at horizontal position (at the same level of heart) after at least 10 minutes resting period. Systolic blood pressure based on 1st Korotkoff auscultation sound and diastolic blood pressure based on 5th Korotkoff auscultation sound were recorded. The measurement of AP was repeated after 6 hours if a patient's AP was measured as high. Patients whose AP was measured as equal or high to 140/90 mmHg were evaluated as hypertensive.

2 spot urine samples at least 6 hours period were taken, cause of deterioration of spot urine samples hour by hour. Patients whose have proteinuria with infection in spot urine samples, were excluded.

Preeclamptic pregnants whose had not a history of hypertension and proteinuria before pregnancy, and had systolic blood pressure <160 mmHg after 20th weeks of pregnancy, diastolic blood pressure <110 mmHg, ≥500 mg proteinuria at 24-hour urine sample, normal liver function tests and normal thrombocyte counts were included into mild preeclampsia group. Systolic blood pressure ≥160 mmHg, diastolic blood pressure ≥110 mmHg, ≥5 gr proteinuria at 24-hour urine sample, oliguria (≤400 ml/24 hour), cerebral visual disorders, epigastric pain, pulmonary edema, liver function disorders, thrombocytopenia were excepted as criteria of severe preeclampsia. Hemolysis

(abnormal peripheral blood smear, bilirubin >1.2 mg/dl, lactate dehydrogenase >600 IU/lt), elevated liver enzymes (SGOT >72 IU/lt) and thrombocytopenia (thrombocyte count <100,000/mm^3) were] excepted as HELLP syndrome diagnosis criteria. Pregnants who diagnosed as eclampsia and HELLP syndrome were included into severe preeclampsia group.

Pregnants who had chronic hypertension, Type I-II DM, connective tissue diseases, multiple pregnancy, chronic renal failure, chronic liver failure, smoking, thrombophilia, hematologic disease, usage of aspirin and heparin were excluded.

Age, parity, number of births, week of pregnancy, type of delivery and birth weight of patients were recorded. Medical and surgery history of patients were taken. Fetal biometric measurements of fetuses that evaluated by US were recorded.

Healthy pregnants who had not hypertension before pregnancy, had not have preeclampsia during pregnancy and had a healthy baby after 37th week of pregnancy were included into control group to compare the groups.

20 ml of blood was taken to a tube with EDTA from antecubital vein by vacutainer to analyze the thrombocyte volume. 2 ml of this was sent to the bacteriology laboratory for complete blood count. It was calculated by complete blood cell count device (Beckman Coulter Co.®Lh 780 Analyzer, Krefeld, Germany). The time between blood drawing and counting has not passed 45 minutes. The average of two MPV values that have taken from complete blood count was calculated. MPV values were recorded as femtoliter. The thrombocyte values were recorded at the same complete blood count.

MPV values of all 3 groups were compared in prenatal and 6 weeks after postnatal period. Differences between both 2 values were evaluated. According to thrombocyte counts, 3 groups were created as <100,000/mm^3, 100,000-150,000/mm^3 and >150,000/mm^3. And relation between thrombocyte counts and MPV values were examined.

Statistical Package for Social Sciences (SPSS) for Windows 15.0 program was used for evaluation of the findings and the statistical analysis. Descriptive statistical methods (Mean, standard deviation, frequency) was used for evaluation of study data. Oneway ANOVA and Tukey HDS tests were used for between groups and within group comparisons. Mann-Whitney U test and Chi-Square test were used for non-parametric data. Results were evaluated in 95% confidence interval and p values that were less than 0.05 wereevaluated as statistically significant.

Results

Demographic properties like age and parity were recorded. There are no significance between age and parity of groups (Table 1).

Week of pregnancy and birth weights of severe preeclampsia group have found significantly lower

Table 1. Demographic characteristics, laboratory findings, and comparison of patterns of birth.

	Group K	Group H	Group A	
	Mean±SS	Mean±SS	Mean±SS	p
Age	28.55±6.35	26.75±5.51	28.50±10.14	0.694
Parity	2.05±0.94	1.90±0.91	2.00±1.13	0.890
Gestational age	39.30±1.03	38.90±1.07	34.38±1.68	<0.01
Birth weight	3331.00±304.11	3235.00±240.16	2433.88±394.18	<0.01
Number of platelet	241650±53504.82	202900±44159.87	98277.78±21115.38	<0.01
Perinatal MPV	7.76±0.58	7.89±0.49	9.75±0.78	<0.01
Postnatal MPV	7.32±0.60	7.84±0.49	8.15±0.39	<0.01
	n (%)	n (%)	n (%)	p
Mode of delivery NSD	16 (80%)	15 (75%)	10 (55.5%)	0.02
C/S	4 (20%)	5 (25%)	8 (44.5%)	

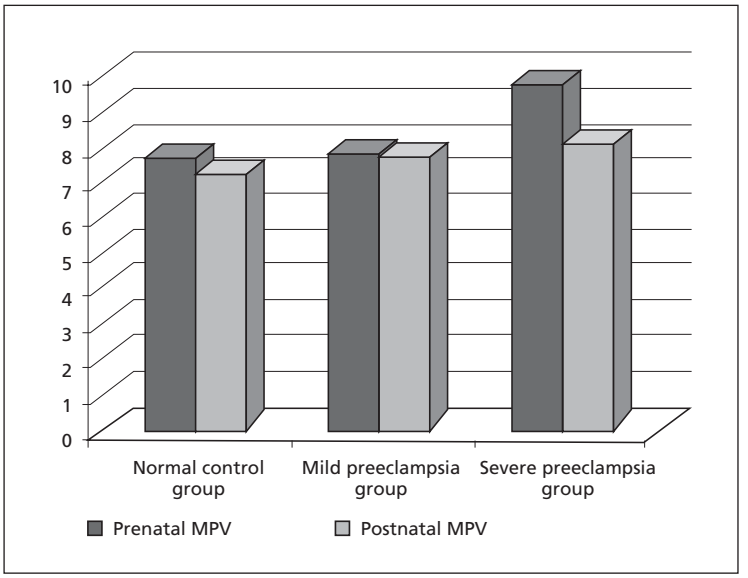

Figure 1. Comparison of mean prenatal and postnatal MPV values among and within groups.

than other two groups. C/S (Caesarean/Sectio) ratio was significantly higher than other two groups.

Thrombocyte counts between groups were found significant ($p<0.05$). Decreased thrombocyte count has been seen with the worsened clinical situation.

In comparison between MPV means and thrombocyte count means, mean thrombocyte volume of the group that has less than 100,000/mm^3 thrombocyte counts was found statistically significant than the other 100,000-150,000/mm^3 and over 150.000/mm^3 thrombocyte counts groups ($p<0.05$, Table 2). Mpv value has been found increased while thrombocyte count was dropped under 100,000/mm^3.

In comparison about MPV values, MPV values of the severe preeclampsia group was found significantly higher than control group ($p<0.05$).

Discussion

Endothelial activation that was responsible for pathophysiology of preeclampsia creates an increase on thrombocyte aggregation. This situation causes a decrease in thrombocyte count for preeclamptic patients. Recent studies have shown that the thrombocyte production and consumption that depended on increased activation in maternal circulation was increasing. The response of bone marrow to increased thrombocyte consumption is to product and release younger and larger throm-

Table 2. Comparison of the groups in platelet number and MPV.

	Perinatal MPV	Number of platelet	p
Number of platelet <100,000 mean±SS (n)	10.11±0.72 (11)	84,454.55±9,872.82 (11)	0.001
Number of platelet 100,000-150,000 mean±SS (n)	9.18±0.48 (7)	120,000±14,142.13 (7)	0.04
Number of platelet >150,000 mean±SS	7.82±0.53 (40)	222,275±52,246.94 (40)	0.232

bocytes from megakaryocytes in bone marrow to blood. Many studies have proved that thrombocyte count and mean thrombocyte volume has an inverse ratio on healthy qindividuals[3,4] Beside these studies, larger thrombocytes were more active and related with vascular disorders.[5]

As a result of this study, MPV values have increased while the severity of preeclampsia was increasing. After the examination of the literature, relation between severity of preeclampsia and thrombocyte volume have found confused.

Boriboonnhirunsarn et al. have suggested in their study that MPV value was increased without a change in thrombocyte count and MPV was a good marker to detect the thrombocyte dysfunction for preeclampsia. However, they reported that more studies was needed to explain as a marker on severity of preeclampsia.[6]

Gioia et al. have compared the control group which has 145 normotensive pregnants with the study group which has 57 preeclamptic with intrauterine growth restriction in their study. They separated the study group into two groups as abnormalities have or have not in maternal and fetal arterial dopplers. In conclusion; they have found that MPV values were significantly higher in the abnormal doppler group.[7]

Şahin et al. have examined mean thrombocyte volumes of normal pregnants with pregnants whose have diagnosed as mild, severe preeclampsia and eclampsia. They included 45 mild preeclamptic pregnants, 31 eclamptic pregnants and 50 normal pregnants into their study. They have found that mean thrombocyte volume of severe preeclamptic group was significantly higher than mild preeclamptic group and control group. They concluded that MPV could be a marker for severity of preeclampsia.[8]

Ceyhan et al. have compared all complete blood count parameters of the control group that contained 43 normal pregnants with the study group that contained 56 preeclamptic pregnants. In this study, they did not find any significance between groups in terms of MPV. And they have explained it differences in equipment and method of the automatic blood count devices. This result was different than our study findings.[9]

Järemo et al. have compared thrombocyte counts in prenatal and postnatal 3rd and 12th months, MPV, neutrophil-monocyte counts, P-selectin in circulation, levels of interleukin-6 and myeloperoxidase on 18 preeclamptic pregnants and 11 normal pregnants in 3rd trimester. They have observed that preeclamptic pregnants had a lower thrombocyte count ($p<0.001$) and a higher MPV value than normal pregnants. Postnatal MPV values of control group were found similar as prenatal values. In the same study, they have found a relation between higher maternal blood pressure with increased MPV values ($p<0.05$).[10] In their study, they have observed that thrombocyte counts were found decreased while severity of preeclampsia was increasing and beside this, MPV values were found higher in prenatal and postnatal period, these findings were observed as similar as in our study.

Dündar et al. have compared 1,336 pregnants whose were normotensive pregnants and preeclamptic pregnants and found that MPV values of preeclamptic pregnants were progressively increased.[11]

All 3 groups have compared between and within their own in terms of MPV values at prenatal, postnatal and postnatal 6 weeks. There were not found any significance between prenatal and postnatal values within groups ($p>0.05$). However, postnatal values of MPV in severe preeclampsia were found higher than the others ($p<0.02$). This result could be interpreted as severe preeclampsia caused a permanent endothelial activation. Similar findings have found in the study of Järemo et al.[10]

Conclusion

As a result; increased MPV value were seen while the severity of preeclampsia was increased. While MPV value which has an easily performed and accessible technique was found high, it might be a warning to the physician to make a detailed review. Beside proved prognostic factors of preeclampsia follow-up, MPV value could be beneficial in severity of preeclampsia. However, in literature, higher MPV values may be seen in normal pregnancies. More extensive studies which includes(include olmalı) more patients is needed for using this parameter in preeclampsia follow-up.

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