Is it Possible to Measure Cardiovascular Risk Over Obese Pregnant Women by Mean Platelet Volume?

Obez Gebe Kadınlarda Ortalama Platelet Hacmi Yoluyla Kardiyovasküler Riskin Ölçülmesi Mümkün müdür?

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ABSTRACT Objective: The aim of this study was to assess mean platelet volume (MPV) values over obese and non-obese pregnant women and in that way, investigating the possibility of cardiovascular risk measurement over obese pregnant women by MPV. **Material and Methods:** We selected 72 obese and 101 non-obese pregnant women for prospective clinical study consecutively during the third trimester of pregnancy. The following laboratory tests have been done for all pregnants on admission: hemoglobin (HGB), hematocrit (HCT), platelet count (PLT) and MPV. For study and control groups, 2 mL of blood was obtained over from antecubital venepuncture without stasis and we measured MPV in a blood sample collected in citrate. Obesity is classified by body mass index (BMI) and defined as BMI ≥ 30.0 kg/m^2 during third trimester. **Results:** No significant difference was determined between obese and non-obese pregnant women regarding to MPV values (10.8 ± 1.2 vs. 10.5 ± 1.1 p> 0.05). **Conclusion:** In our study, we could not find any difference between obese and non-obese pregnant women by using MPV values. But, it shouldn't be forgotten that obesity is associated with increased risks of pregnancy complications.

Key Words: Pregnancy; obesity; heart diseases; complications; blood platelets

ÖZET Amaç: Bu çalışmanın amacı, obez ve obez olmayan gebe kadınlarda ortalama platelet hacmi (MPV) değerlerinin tayin edilmesi ve bu şekilde MPV yoluyla obez gebe kadınlarda kardiyovasküler risk ölçümünün olabilirliğini araştırmaktır. **Gereç ve Yöntemler:** Gebeliğin üçüncü trimesteri sırasında 72 obez ve 101 obez olmayan gebe kadını ardışık olarak prospektif klinik çalışma için seçtik. Aşağıdaki laboratuvar testleri başvuru sırasında tüm gebeler için yapıldı. Hemoglobin (HGB), hematokrit (HCT), platelet sayımı (PLT) ve MPV. Çalışma ve kontrol grupları için ön kol ön yüzündeki toplardamar üzerinden staz oluşumu yapmadan 2 mL kan alındı ve sitrat içinde toplanmış olan kan örneğinden MPV ölçümlerini yaptık. Obezite, beden kitle indeksi (BKİ) ile değerlendirildi ve üçüncü trimesterde BKİ'nin ≥ 30.0 kg/m^2 olması şeklinde tanımlandı. **Bulgular:** Obez ve obez olmayan gebe kadınlar arasında MPV değerleri göz önüne alındığı zaman belirgin bir farklılık saptanmadı (10.8 ± 1.2 ile 10.5 ± 1.1 p> 0.05). **Sonuç:** Çalışmamızda, MPV değerlerini kullanarak obez ve obez olmayan gebe kadınlar arasında herhangi bir farklılık bulamadık. Ancak obezitenin, artmış gebelik komplikasyonlarıyla ilişkili olduğu unutulmamalıdır.

Anahtar Kelimeler: Gebelik; obezite; kalp hastalıkları; komplikasyonlar; trombositler

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Mean platelet volume (MPV), is a marker of platelet activation and it is an independent cardiovascular risk factor.[1-3] Determination of MPV is a simple procedure, available in most hospital laboratories and it is a simple, quick and cost-effective test. Elevated MPV values are

associated with non-obstetric pathologies, such as cardiovascular events.[3,4]

Elevated MPV measurements are also together with various obstetric pathologies, such as preeclampsia characterized by an impaired trophoblast invasion which causes endothelial damage.[5,6] The contact of platelets with the damaged endothelium may lead to increased consumption of platelets, after that, there may be a compensatory increase in bone marrow platelet production.[7] Young and immature platelet thrown in circulation are bigger and it may explain the reason of MPV increase.

Obesity is a major public health problem and known as risk factor for several diseases especially for cardiovascular diseases (CVD).[8] In last decades, dramatically increase in obesity also influences pregnant women. 28% of these women are overweight and 11% of them are obese and as it is expected that obesity in pregnancy have increased incidence of various complications for mother and baby.[9] Furthermore, maternal body mass index (BMI) shows strong associations with pregnancy complications and outcomes.[9,10] Due to that fact, obesity during pregnancy has been reported with numerous complications as shown in previous study, it was suggested that obese pregnant women should be closely followed up and carefully monitored during delivery in order to lower the high risk of adverse pregnancy outcome.[11]

During normal pregnancy, it is known that MPV values may increase significantly but based on our knowledge, over obese pregnant women, MPV measurements have not been studied previously.[12] In that case, the aim of this study was to evaluate MPV measurements over obese pregnant women and to investigate the possibility of cardiovascular risk measurement over obese pregnant women by MPV.

MATERIAL AND METHODS

Seventy-two obese and 101 non-obese pregnant women have been recruited consecutively into the prospective clinic study during the third trimester of pregnancy. The study was carried out at Afyonkarahisar Kocatepe University, Department of Obstetrics and Gynecology. Approval for the study was obtained from the Ethics Committee of Afyonkarahisar Kocatepe University and written informed consent was obtained from all women before enrollment according to Helsinki Declaration principles.

Obesity is classified by BMI and defined as BMI ≥ 30.0 kg/m^2 during third trimester. The BMI was calculated by division of the weight (kg) to height squared (m^2). Exclusion criterias for obese and non-obese pregnant women might be pre-eclampsia, gestational hypertension, gestational diabetes mellitus, intrauterine growth retardation, thyroid diseases, multiple pregnancies, cardiovascular diseases, smoking or renal diseases.

The following laboratory tests have been done for all women on admission: hemoglobine (HGB), hematocrit (HCT), platelet count (PLT) and MPV. For study and control groups, 2 mL of blood has been obtained by antecubital venepuncture without stasis and MPV was measured in a blood sample collected in citrate (v : v, 4 : 1). A Sysmex XT- 2000i (Sysmex Ltd, Buckinghamshire, UK) was used for whole blood counts.

The data has been analyzed with Windows SPSS version 14.0 installed in PC. Statistical results are expressed by the mean ± standard deviation. The independent samples t-test was used to detect differences between the groups. Statistically, p value which is less than 0.05, has been considered as significant.

RESULTS

Clinical characteristics of study groups are presented in Table 1. The groups were similar regarding to age, gestational age and hematologic parameters.

As expected, obese pregnant women had higher BMI values (33.2 ± 2.9 vs. 25.7 ± 2.3, $p < 0.001$).

Laboratory parameters of patients and perinatal outcome are presented in Table 2.

Any significant difference was determined between obese and non-obese pregnant women regarding to MPV values (10.8 ± 1.2 vs. 10.5 ± 1.1 $p > 0.05$) and other hematologic parameters.

TABLE 1: Clinical characteristics of patients.

	Obese pregnant women	Non-obese pregnant women	p
Age (years)	27.6 ± 5.3	26.4 ± 3.9	NS
Parity	1.3 ± 1.1	0.9 ± 1.1	0.014
BMI (kg/m^2)	33.2 ± 2.9	25.7 ± 2.3	< 0.001
Gestational age (weeks)	37.4 ± 1.4	37.8 ± 1.5	NS

NS: non significant; BMI: body mass index.

TABLE 2: Laboratory parameters of patients and perinatal outcome.

HGB (g/dL)	12.5 ± 1.2	12.3 ± 1.3	NS
HCT (%)	37.2 ± 3.5	36.5 ± 3.4	NS
PLT (106/mm^3)	211.4 ± 77.8	212.6 ± 68.5	NS
MPV (fl)	10.8 ± 1.2	10.5 ± 1.1	NS
Birthweight (g)	3313.5 ± 433.0	3231.5 ± 383.9	NS
Apgar 1 min.	8.7 ± 0.8	8.7 ± 0.7	NS
Apgar 5 min.	9.9 ± 0.4	9.9 ± 0.4	NS

HGB: hemoglobin; HCT: hematocrit; PLT: platelet; MPV: mean platelet volume; NS: non significant; BMI: body mass index.

There was no statistically significant difference based on birth weight and Apgar scores from 1 minute to 5.

DISCUSSION

Obesity is a chronic metabolic disorder and an independent predictor of multiple cardiovascular events.[13] Obesity during pregnancy is especially important due to multiple risks. Increasing BMI is associated with increased incidence of hypertensive disorders of hypertension, gestational diabetes mellitus and delivery complications.[10,14-18] Furthermore, obesity is an independent cardiovascular risk factor, maternal obesity might also be a risk factor. As far as we know, MPV measurements over obese pregnant women have not been reported yet. In our study, significant difference was not determined between obese and non-obese pregnant women regarding to MPV values. Previous studies have been shown the direct association between MPV and obesity. Also, MPV has been altered with diet and exercise over obese non-pregnant population.[19,20] However, in these studies, as predicted, the age of the study population was higher than these pregnant women and this factor might effect directly the results of the study. Based on our study, all pregnants were at the period of the third trimester and MPV measurements still increase during the third trimester in normal pregnancy, but it would be more accurate to know MPV values of first, second and third trimester of pregnant women.[12]

In normal pregnancy, although platelet functions are more complex, there are various evidence of increased platelet aggregation and increased platelet activation.[12,21,22] Nevertheless, there are conflicting results regarding to platelet activity in previous studies.[23,24] These conflicting results might not be supported by the concept of MPV measurements as a determinant of platelet activation. Besides this, in this structure, larger studies should be needed. Various studies which investigates the relationship of maternal obesity with fetal growth and birthweight, have shown that obese women have increased incidence of macrosomic fetuses.[9,11,25,26] In our study, apart from the other studies, Apgar scores and fetal birth weights were comparable between the obese and non-obese

pregnants. Enlarging the population and taking obese women before pregnancy might change the results of the study.

Several laboratory techniques have been developed to detect platelet activation. These are platelet volumes and sizes, radiolabeling methods, aggregometry procedures, adhesion molecules etc.[27] As known, several studies proposed that a larger MPV is an indicator of increased platelet activation.[28-30] But MPV measurements have few important limitations. Chosen method for measurement, chosen anticoagulant for collection and the time until considering MPV measurement might influence the power of MPV measurement.[28,31,32] In that case, adhesion molecules that used to show platelet activation seem like more sensitive.[6,33] In this study, for indicator of platelet activation we have used MPV instead of other markers over obese pregnant women and this might be limitation of our study.

Another limitation was the excluded criterias over obese pregnant women. Obese pregnant women with cardiovascular diseases, hypertensive disorders and other medical conditions were excluded to clarify the obesity related with complications of MPV values. Although obesity during pregnancy is highly associated with various diseases, these criterias are not considerable due to the young population of our study and do not reduce the importance of our clinical results.[10,14-16,34]

As a result, we have not found any difference between obese and non-obese pregnants in MPV measurements. MPV might not be used as a marker for the detection of obese pregnant women at risk for cardiovascular disease.

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REFERENCES

1. Greisenegger S, Endler G, Hsieh K, Tentschert S, Mannhalter C, Lalouschek W. Is elevated mean platelet volume associated with a worse outcome in patients with acute ischemic cerebrovascular events? Stroke 2004;35(7):1688-91.
2. Endler G, Klimesch A, Sunder-Plassmann H, Schillinger M, Exner M, Mannhalter C, et al. Mean platelet volume is an independent risk factor for myocardial infarction but not for coronary artery disease. Br J Haematol 2002;117(2):399-404.
3. Martin JF, Bath PM, Burr ML. Influence of platelet size on outcome after myocardial infarction. Lancet 1991;338(8780):1409-11.
4. Senaran H, Ileri M, Altinbaş A, Koşar A, Yetkin E, Oztürk M, et al. Thrombopoietin and mean platelet volume in coronary artery disease. Clin Cardiol 2001;24(5):405-8.
5. Gioia S, Piazze J, Anceschi MM, Cerekja A, Alberini A, Giancotti A, et al. Mean platelet volume: association with adverse neonatal outcome. Platelets 2007;18(4):284-8.
6. Järemo P, Lindahl TL, Lennmarken C, Forsgren H. The use of platelet density and volume measurements to estimate the severity of pre-eclampsia. Eur J Clin Invest 2000; 30(12):1113-8.
7. Piazze J, Gioia S, Cerekja A, Larciprete G, Argento T, Pizzulo S, et al. Doppler velocimetry alterations related to platelet changes in third trimester pregnancies. Platelets 2007;18(1): 11-5.
8. Poirier P, Giles TD, Bray GA, Hong Y, Stern JS, Pi-Sunyer FX, et al. American Heart Association; Obesity Committee of the Council on Nutrition, Physical Activity, and Metabolism. Obesity and cardiovascular disease: pathophysiology, evaluation, and effect of weight loss: an update of the 1997 American Heart Association Scientific Statement on Obesity and Heart Disease from the Obesity Committee of the Council on Nutrition, Physical Activity, and Metabolism. Circulation 2006;113(6):898-918.
9. Bhattacharya S, Campbell DM, Liston WA, Bhattacharya S. Effect of Body Mass Index on pregnancy outcomes in nulliparous women delivering singleton babies. BMC Public Health. 2007;7:168.
10. Sebire NJ, Jolly M, Harris JP, Wadsworth J, Joffe M, Beard RW, et al. Maternal obesity and pregnancy outcome: a study of 287,213 pregnancies in London. Int J Obes Relat Metab Disord 2001;25(8):1175-82.
11. Raatikainen K, Heiskanen N, Heinonen S. Transition from overweight to obesity worsens pregnancy outcome in a BMI-dependent manner. Obesity (Silver Spring) 2006;14(1):165-71.
12. Fay RA, Hughes AO, Farron NT. Platelets in pregnancy: hyperdestruction in pregnancy. Obstet Gynecol 1983;61(2):238-40.
13. Pérez Pérez A, Ybarra Muñoz J, Blay Cortés V, de Pablos Velasco P. Obesity and cardiovascular disease. Public Health Nutr 2007;10(10A):1156-63.
14. Walsh SW. Obesity: a risk factor for preeclampsia. Trends Endocrinol Metab 2007;18(10):365-70.
15. Nuthalapaty FS, Rouse DJ. The impact of obesity on obstetrical practice and outcome. Clin Obstet Gynecol 2004;47(4):898-913.
16. Yogev Y, Langer O. Pregnancy outcome in obese and morbidly obese gestational diabetic women. Eur J Obstet Gynecol Reprod Biol 2008;137(1):21-6.
17. Barau G, Robillard PY, Hulsey TC, Dedecker F, Laffite A, Gérardin P, et al. Linear association between maternal pre-pregnancy body mass index and risk of caesarean section in term deliveries. BJOG 2006;113(10):1173-7.
18. Dietl J. Maternal obesity and complications during pregnancy. J Perinat Med 2005;33(2):100-5.
19. Coban E, Yilmaz A, Sari R. The effect of weight loss on the mean platelet volume in obese patients. Platelets 2007;18(3):212-6.
20. Toplak H, Wascher TC. Influence of weight reduction on platelet volume: different effects of a hypocaloric diet and a very low calorie diet. Eur J Clin Invest 1994;24(11):778-80.

21. Sill PR, Lind T, Walker W. Platelet values during normal pregnancy. Br J Obstet Gynaecol 1985;92(5):480-3.

22. Pillai M. Platelets and pregnancy. Br J Obstet Gynaecol 1993;100(3):201-4.

23. Ahmed Y, van Iddekinge B, Paul C, Sullivan HF, Elder MG. Retrospective analysis of platelet numbers and volumes in normal pregnancy and in pre-eclampsia. Br J Obstet Gynaecol 1993;100(3):216-20.

24. Tygart SG, McRoyan DK, Spinnato JA, McRoyan CJ, Kitay DZ. Longitudinal study of platelet indices during normal pregnancy. Am J Obstet Gynecol 1986;154(4):883-7.

25. Weiss JL, Malone FD, Emig D, Ball RH, Nyberg DA, Comstock CH, et al. FASTER Research Consortium. Obesity, obstetric complications and cesarean delivery rate--a population-based screening study. Am J Obstet Gynecol 2004;190(4):1091-7.

26. Yu CK, Teoh TG, Robinson S. Obesity in pregnancy. BJOG 2006;113(10):1117-25.

27. Tsiara S, Elisaf M, Jagroop IA, Mikhailidis DP. Platelets as predictors of vascular risk: is there a practical index of platelet activity? Clin Appl Thromb Hemost 2003;9(3):177-90.

28. Park Y, Schoene N, Harris W. Mean platelet volume as an indicator of platelet activation: methodological issues. Platelets 2002;13(5-6):301-6.

29. Threatte GA, Adrados C, Ebbe S, Brecher G. Mean platelet volume: the need for a reference method. Am J Clin Pathol 1984;81(6):769-72.

30. Jagroop IA, Mikhailidis DP. Mean platelet volume is a useful parameter: a reproducible routine method using a modified Coulter Thrombocytometer. Platelets 2001;12(3):171.

31. Jagroop IA, Clatworthy I, Lewin J, Mikhailidis DP. Shape change in human platelets: measurement with a channelyzer and visualisation by electron microscopy. Platelets 2000;11(1):28-32.

32. Bath PM, Butterworth RJ. Platelet size: measurement, physiology and vascular disease. Blood Coagul Fibrinolysis 1996;7(2):157-61.

33. Karalis I, Nadar SK, Al Yemeni E, Blann AD, Lip GY. Platelet activation in pregnancy-induced hypertension. Thromb Res 2005;116(5):377-83.

34. ESHRE Capri Workshop Group. Hormones and cardiovascular health in women. Hum Reprod Update 2006;12(5):483-97.