Original Article

DOI: 10.21276/APALM.1932

Comparative Study of Platelet Indices in Normal Pregnant and Non-Pregnant Women in a Tertiary Care Hospital in Northern India

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ABSTRACT

Aims and Objectives: To compare Platelet Indices between pregnant females and non-pregnant females attending the Antenatal Clinic in a tertiary care hospital. Platelet Indices amongst pregnant women between the three trimesters were also compared.

Materials and Methods: A case control study was conducted in the Department of Pathology, ESIC Medical College and Hospital, Faridabad, Haryana India on 119 normal pregnant females and 119 non-pregnant normal females in the reproductive age group (18 to 45 years) with the approval of the ethical committee. Venous blood was collected from all participants in EDTA vacutainer and CBC was performed using fully automated analyser, XN 1000 within 2 hours of sample collection. The data were analysed using SPSS software 17.0. Unpaired Student t-test was applied to compare the various platelet indices between the cases and controls. One-way ANOVA was applied to study between group differences among the three different trimesters of pregnancy for the platelet counts and indices.

Results: Platelet count was found to be higher among controls as compared to cases and this was found to be statistically significant (p=0.017). Platelet count was highest among subjects in the first trimester and subsequently decreased among subjects in the second and third trimester. But was not statistically significant. An inverse relationship was seen between MPV and Platelet Count, this was statistically significant.

Conclusion: The Platelet count and Indices were reduced in normal pregnancy. However, owing to a small sample size, the statistical significance of various platelet indices between cases and controls and among the three trimesters were limited.

Keywords: *Platelets, Platelet Indices, Pregnancy, Trimester, Automated*

Introduction

Platelets are megakaryocyte cytoplasmic fragments in the bone marrow. An average of 1500 to 2000 platelets are released from a single megakaryocyte in the circulation. The lifespan of platelets is 7 to 10 days. The size of the platelets ranges from 3 to 5 microns in diameter. These are discoid and anucleate in the inactive state. [1] The primary function is in haemostasis and prevention of bleeding, angiogenesis, wound healing and microbial defines mechanisms. Platelets play an essential role in the process of thrombogenesis, as well as an important role in atherogenesis and the progression of atherosclerotic lesions. [2] Platelets are recruited at the sites of injury and along with leucocytes and endothelial cells, gets activated. [3] In the activated state the platelets undergo a shape change and release bioactive molecules stored in their alpha and dense granules. [4]

A normal platelet count in a healthy individual is between 150,000 and 450,000 per µl (microlitre) of blood (150–450 $\times 10^9$/L). Ninety-five percent of healthy people will have platelet counts within this range. [5]

Pregnancy is associated with endothelial stress and increased platelet aggregation in the uteroplacental circulation. Also, the increase in plasma volume associated with pregnancy results in a dilutional thrombocytopaenia [6].

Pregnancy is associated with several changes in platelet count and platelet indices arising from increased platelet consumption in the uteroplacental circulation and haemodilution.

Platelet counts and platelet indices can be rapidly measured using the automated hematology analysers. Platelet indices are biomarkers of platelet activation which has diagnostic and prognostic values in various clinical settings which can be easily obtained without incurring additional costs [1,7].

Platelet counts are generally lower in pregnancy and thrombocytopenia is seen only in 10% of the cases. There is increased levels of thromboxane A2, intracellular

calcium and reduced synthesis of cyclic AMP which leads to platelet aggregation. The reduction in platelet count is not severe to cause maternal and neonatal morbidity and mortality [8, 9].

The mean platelet Volume (MPV) which reflects the platelet size, increases during pregnancy as bone marrow releases larger and younger platelets to compensate for the rapid consumption of platelets in pregnancy. [10,11].

Plateletcrit (PCT) which is a measure of the platelet volume in a given volume of blood decreases during pregnancy as pregnancy is characterised by increased blood volume.

The aim of the present study was to compare platelet indices between cases (pregnant patients) and controls (non-pregnant patients) attending a tertiary care hospital OPD. In addition, platelet indices among pregnant women between the three trimesters were also compared.

Materials and Methods

A case control study was conducted in the Department of Pathology, ESIC Medical College and Hospital Faridabad, in Northern India on 119 normal pregnant females and 119 non-pregnant normal females in the reproductive age group (18 to 45 years). Prior approval of the Institutional Ethical Committee and informed consent of all the participants were taken. 5ml of venous blood was collected from each participant in EDTA vacutainer and CBC was performed using fully automated 5 part hematology analyser, XN 1000 within 2 hours of sample collection. All patients with a known history of hypertension, diabetes, bleeding disorders/coagulopathies and anaemia were excluded from the study.

The data were analysed using SPSS software 17.0. Unpaired Student t-test was applied to compare the various platelet indices between the cases and controls. One way ANOVA was applied to study between group differences among the three different trimesters of pregnancy for the platelet counts and indices.

Result

On applying t-test, (table 1) PLT was found to be higher among controls as compared to cases and this was found to be statistically significant (p=0.017).

MPV, P-LCR (platelet large cell ratio), PCT and PDW(platelet distribution width) was found to be higher among controls as compared to cases, however, these were not found to be statistically significant (p = 0.974; p=0.496; p=0.051; P= 0.343 respectively).

On one-way ANOVA (as shown in Table 2), it was found that platelet count was highest among subjects in the first trimester and subsequently decreased among subjects in the second and third trimester. However, this was not found to statistically significant [F (2,116) = 0.716]; p=0.491. PCT showed a similar falling trend from first to third trimester. However, this also was not found to be statistically significant [F (2,116) = 2.459]; p=0.09.

On applying correlation statistic between MPV and PLT, an inverse relationship was seen between MPV and platelet among both cases and control i.e. as MPV increased as platelet count decreased and this was found to statistically significant (r = -0.562, p =0.00; r = -0.429, p =0.00 respectively).

Table 1: Comparison of Platelet indices among pregnant and non-pregnant patients.

Platelet indices		Mean ± S.D.	T statistic	Confidence interval		P value
				Lower limit	Upper limit	
PLT	Case	2.417 ± 0.745	2.413	0.051	0.507	0.017
	Control	2.69 ± 1.01				
PDW	Case	16.16 ± 4.37	0.951	-0.543	1.55	0.343
	Control	16.66 ± 3.82				
MPV	Case	11.987 ± 2.51	0.033	-0.538	0.557	0.974
	Control	11.997 ± 1.70				
P-LCR	Case	39.55 ± 11.46	0.682	-2.01	4.15	0.496
	Control	40.62 ± 12.66				
PCT	Case	0.29 ± 0.093	1.961	-0.00011	0.046	0.051
	Control	0.318 ± 0.089				

Table 2: Comparison in platelet indices among three trimesters.

Platelet Indices		Mean ± S.D.	F statistic	P value
PLT	First	2.53 ± 0.689	0.716	0.491
	Second	2.39 ± 0.783		
	Third	2.33 ± 0.765		
PDW	First	15.69 ± 4.20	0.331	0.719
	Second	16.47 ± 4.03		
	Third	16.30 ± 4.82		
MPV	First	11.71 ± 1.51	1.383	0.255
	Second	12.56 ± 3.89		
	Third	11.75 ± 1.6		
P-LCR	First	38.23 ± 11.2	0.672	0.513
	Second	41.28 ± 11.11		
	Third	39.27 ± 12.02		
PCT	First	0.33 ± 0.073	2.459	0.09
	Second	0.31 ± 0.132		
	Third	0.27 ± 0.064		

Discussion

Platelets are anucleate cellular components of blood derived from bone marrow megakaryocytes. Usually, the platelets are evaluated for their size, number, distribution and structure on a well prepared peripheral smear. However, manual methods are subject to artifacts and misdiagnosis. Hence the manual methods are improved upon by the Automated analysers which are used for precise evaluation of different platelet indices. These analysers use the principle of impedance counting or optical light scatter counting techniques.

Measurement of all platelet indices during pregnancy will help to study the variations in these parameters arising during pregnancy when compared with the normal control group.

Pregnancy is a hypercoagulable state to prevent the blood loss following delivery. Several research have shown that there are changes in platelet indices with activation of the coagulation system . [12]

MPV acts as an acute phase reactant. It decreases and increases in acute and chronic disorders. [13] MPV is a measurement of the average size of platelets found in blood and is typically included in blood tests. Since the average platelet size is larger when the body is producing increased numbers of young platelets, MPV test results can be used to make inferences about platelet production in bone marrow. [14] Platelet Volume is associated with cytokines that regulate megakaryocyte ploidy and platelet number and results in the production of the larger platelet. [15,16,17] In pregnancy MPV is increased due to release of immature platelets from the marrow as a result of stress.

The present study shows there is decrease in MPV among the normal pregnant females with the progression of pregnancy. MPV is seen to increase more in preeclamptic pregnant females when compared with normal pregnancy along with low PC. There are variable results in the literature between platelet number and volume suggesting these are affected by different mechanisms. [18,19,20].

Plateletcrit is the volume of platelets occupied in the blood as percentage (1) and calculated as platelet count x MPV/10000 [20,21,22]

The plateletcrit is reduced in the present study which corresponds to the increase in blood volume in pregnancy. This finding corresponds to the other studies.

The PDW which corresponds to the platelet anisocytosis and is an indicator of volume variability of platelets. It changes with platelet activation and reflects variation in platelet morphology. [23] Both MPV and PDW change in the same direction under physiological conditions.

PDW is reduced in this study. Low PDW shows there is not much marked variation in platelet size during the course of pregnancy when compared to the normal control.

PLC ratio is used in the in the differential diagnosis of conditions associated with abnormal platelet counts. [24] It indicates circulating larger platelets. It aids in monitoring platelet activity. [25] PLCR ratio is found to be higher among normal controls as compared to the pregnant females in this study.

Reports have shown that the platelet count (PLT) and the plateletcrit (PCT) decrease, while the mean platelet volume (MPV) and the platelet distribution width (PDW) increase with gestational age. These physiologic changes should be noted while interpreting the results of platelet parameters.[26] Age, sex, race and methodology and instruments are known to influence the platelet parameters.[26]

The present study shows a similar correlation exists amongst different platelet indices when compared with previous studies. However, the PDW and MPV were higher in the controls as compared to the cases in the present study. This could be explained by fact that this was across sectional study as random cases were selected in the OPD presenting at different period of gestation. Longitudinal study was not feasible in this ESIC set up as all of these cases may not come for each trimester visit and delivery as this is a tertiary care centre. At the same time, some cases may present only at the advanced stage or at term.

Conclusion

The platelet count was found to be reduced in pregnancy and was found to be statistically significant while all other indices although was reduced in pregnancy were not statistically significant. An inverse correlation was found between platelet count and MPV and was statistically in both cases and controls.

Despite a large number of studies on platelet indices, these are not commonly used in routine practices as these are not very specific and conclusive of a particular condition. It is due to lack of uniformity of measurement in different analysers which uses different principles and methodologies like optical impedance and fluorescence methods. To conclude the uniformity of measurements methodologies is must to make the data comparable along with much larger studies using data which incorporates different socioeconomic conditions and ethinicities to make them useful for daily references. It was pilot study which can be extended to corporate set ups and study done over an extended time period to include various seasonal variations. The present study was time bound for 2 months when viral infections and mosquito bites were more which might have effected the platelet parameters.

Owing to a small sample size, statistical significance of various platelet indices between cases and controls and among the three trimesters were limited in the present study.

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Financial or other Competing Interests: None.