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Platelet Indices in Pregnant Women in Port Harcourt, Nigeria

Pughikumo O C[1], Pughikumo DT[2], Iyalla C [3]
[1](Department of Haematology/Immunology, Faculty of Basic Medical Sciences, Niger Delta University,Wilberforce Island,Bayelsa State, Nigeria)
[2](Human Physiology, Faculty of Basic Medical Sciences, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria)
[3] (Department of Haematology ,Blood Transfusion & Immunology, Faculty of Basic Medical Sciences,College of Health Sciences, University of Port Harcourt, Rivers State, Nigeria.)

Abstract: *Pregnancy is associated with several changes in platelet count and platelet indices arising from increased platelet consumption in the uteroplacental circulation and haemodilution. 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 as they are helpful in the early detection of states of super-imposed platelet consumption like pre-eclampsia, ectopic pregnancy, preterm labour and the HELLP syndrome. This study was aimed at deriving normal platelet parameters in pregnancy in Port Harcourt using the haematology auto analyser, PCE 210 (N) ERMA. The mean platelet count for the pregnant women was 212.74 ± 63.28 x 109/L; the mean MPV 9.99 ±1.94fL; the mean PCT was 0.21 ± 0.05% and PDW was 12.68 ± 1.91fL. Our study also confirmed the concept of platelet consumption in pregnancy.*

Keywords: *Mean platelet volume, Platelet count, Plateletcrit, Platelet distribution width, Pregnancy.*

I. Introduction

Platelets are small discoid, anucleate blood cells with an active role in the maintenance of vascular integrity and primary haemostasis. Abnormal platelet activation is involved in the pathogenesis of several disorders with thrombogenic and atherogenic components like coronary artery diseases, cerebrovascular diseases, diabetes mellitus, Alzheimer's disease, renal diseases, and pre eclampsia/eclampsia[1,2]. Pregnancy is associated with endothelial stress, and increased platelet aggregation in the uteroplacental circulation resulting in a progressive fall in platelet count with increasing gestational age. Also, the increase in plasma volume associated with pregnancy results in a dilutional thromocytopaenia[3]. Thus, platelet counts are generally lower in pregnancy compared to non-pregnant women, and thrombocytopaenia is seen in about 10% of pregnancies.

Rarely, this may be severe enough to cause maternal and neonatal morbidity and mortality[2,4]. The elevated platelet aggregation in pregnancy has been attributed to increased formation of thromboxane A2, more intracellular calcium mobilisation and reduced synthesis of cyclic AMP. Some studies have also reported increased plasma levels of β-thromboglobulin, and GP53 (CD63), a marker of lysosomal membrane in the third trimester[2,5].

As the bone marrow compensates for the rapid consumption of platelets by releasing younger and larger platelets, the mean platelet volume (MPV) which is an index of the average platelet size tend to increase[6,7] An inverse relationship between platelet count (PLT) and MPV was reported as in non-pregnant women8 . The platelet distribution width (PDW), a measure of platelet anisocytosis, was also reported to increase in the course of normal pregnancy[8,9]. Marcelina-Roumans, et al[10] in a study of smoking and non-smoking pregnant women also found an increase in PDW while plateletcrit (PCT), a measure of the relative volume of platelets in a given volume of whole blood, decreased throughout pregnancy.

Platelet parameters have been found to have a predictive value in the evolution of pre-eclampsia. Hutt et al [11] reported an increase in MPV which was noted about two weeks before the increase in blood pressure and other clinical features of pre-eclampsia developed. Some studies reported lower platelet counts and higher PDW, MPV, and platelet-large cell ratio (P-LCR) in patients with pre-eclampsia and eclampsia compared to normal pregnant women[12,13]. Thus platelet count and platelet indices can be of diagnostic and prognostic significance in pre-eclampsia and eclampsia.

The aim of this study was to ascertain the normal values of platelet and platelet indices in pregnancy and compare these values with those of non-pregnant women in Port Harcourt.

II. Materials And Methods

One hundred and fifty (150) apparently healthy pregnant women on their first antenatal visit to three health care facilities in Port Harcourt were recruited into the study. The health care facilities were: the

University of Port Harcourt Teaching Hospital (UPTH), Alakahia; the Demonstration clinic of the Rivers State College of Health Science and Technology (RSCHST), Rumueme, and the Family support health centre, Orogbum. It was a cross-sectional study done between July and September, 2009, preceded by an approval from the Ethics Committee of the UPTH, Port Harcourt (UPTH/CS&T/118/VOLXII/405). Written informed consent was obtained from all participants.

One hundred and twenty six (126) apparently healthy non-pregnant women of reproductive age volunteered were used as controls, but only 102 blood samples were eventually analysed. They were drawn from staff of the UPTH, Port Harcourt and patient relatives in the hospital. Additional volunteers were recruited from three churches in Port Harcourt; Living Faith Church, Mgbuoba, Zion Baptist Church, Rumuepirikom, and Goodland Baptist Church, Rumuigbo. The study was conducted between July and October, 2009.

Exclusion criteria included women who were ill, active bleeding from any site; blood pressure ≥ 140/90mmHg; major surgery or road traffic accident in the last one year, and women with known haemoglobinopathy.

Data were collected from the case files of the pregnant women and a structured user-administered questionnaire was used for both subjects and controls. Five milliliters (ml) of venous blood was then collected by venepuncture from each participant into potassium ethylene diamine tetra acetic acid (EDTA) bottles. The blood samples were analysed within 2-3 hours of collection in the Haematology laboratory at the University of the Port Harcourt Teaching Hospital (UPTH), for complete blood count (CBC) in an automated cell counter, PCE-210 (N), ERMA. The platelet parameters were obtained from the print-outs from the machine.

Statistical Analysis: The data generated was analysed using the Microsoft Excel, 2007 and EPI-INFO version 6.1softwares. Differences between the means in the groups were assessed using the student's t-test and p-values below 0.05 (5%) were considered significant.

III. Results

The pregnant women were aged between 19 and 41 years. Twenty-three (23) of the women were in their first trimester, 76 in their second trimester while 51 were in their third trimester. The non-pregnant controls were aged between 19 and 47 years. The range of the platelet parameters for the pregnant women were as follows: Platelet count (PLT), 74-499 x 109 /L; mean platelet volume (MPV), 7.2-13.4fL; plateletcrit (PCT), 0.11-0.37% and; platelet distribution width (PDW), 8.2-17.5fL. The mean (μ), standard deviation (SD), μ-2SD, and μ+2SD for PLT, MPV, PCT and PDW are shown in TABLE I.The trimester distribution of the platelet parameters is presented in TABLE II.

The platelet count (PLT) reduced with increasing gestational age, but the differences were not statistically significantly. The mean platelet volume (MPV) reduced between the first and the second trimester but rose again in the third trimester. The plateletcrit (PCT) reduced from the first to the second trimester but remained the same in the third trimester. The platelet distribution width (PDW) reduced with increasing gestational age, but the differences were not significant (p-value = 0.78). TABLE III shows the comparison between platelet parameters of pregnant women in this study with that of non-pregnant women of reproductive age (p-value, 0.01). PLT was lower in pregnant women, PCT and PDW were slightly lower in pregnant women, but MPV was higher in pregnant women though these differences were insignificant.

IV. Discussion

Booking late has been identified as a problem hampering comprehensive antenatal care (ANC) in many developing countries[14,15]. In our study, only 23 women (15.3%) booked in their first trimester. This makes it difficult to undertake a longitudinal study in pregnancy. Our study found PLT to be lower in pregnant women than non-pregnant women.PCT and PDW were also slightly lower in pregnant women, but MPV was higher in pregnant women. This is in line with the concept of increased platelet consumption and subsequent replacement with younger and larger platelets reported in pregnancy[2-4].

The mean platelet count (PLT) for the study population was 212.74 x 109/L (SD, 63.28). This is higher than 193 x 109/L (SD, 46.0) reported by Obisesan et al [16] in pregnant women in Ibadan, Nigeria; but lower than 228.29 x 109/L reported by Akinbami et al [17] in Lagos, Nigeria. Similar to our findings, these studies reported higher platelet counts in non-pregnant controls. TABLE IV compares the platelet parameters from our study with findings from other studies. Platelet parameters are known to vary with sex, age, race, methodology, and instrument. So, individual laboratories are expected to derive their reference ranges for appropriate interpretation of results [18].

We found decreasing platelet counts as pregnancy progressed but the differences were not statistically significant (1st and 2nd trimesters, p-value, 0.18; 2nd and 3rd trimesters, p-value, 0.55; and the first and third trimesters, 0.09). This was also reported by Akinbami et al, [17] but there was no consistent decrease in platelet count with gestational age from the studies by Onwukeme et al [19] in Jos and Akingbola et al [20] in Ibadan,

all in Nigeria. This is probably because our studies were cross-sectional with varying numbers of women in the three trimesters. This makes it very difficult for statistical comparison.

The plateletcrit (PCT) in our study decreased predictably from the first to the second trimester in agreement with the report of Marcelina-Roumans et al [10]. This is presumably due to increased platelet consumption and haemodilution. But there was no significant change between the second and third trimester. The change in MPV and PCT with gestational age was not consistent in this study.

However, in a longitudinal study by Tygart et al [21] in Caucasians, platelet counts reduced while MPV increased with gestational age, though the differences were not significant between the second and third trimester, but PDW rose significantly with gestational age. Also, a longitudinal study by Dadhich et al [22] in India, showed that PLT decreased while MPV increased with gestational age in a non-significant manner, but PDW increased significantly from 32 to 40 weeks of gestation. In both studies, these changes were highly significant in women who later developed pre-eclampsia and were found to have a predictive value as they preceded the increase in blood pressure. Our study did not involve women at the tail end of pregnancy when most of the changes in MPV and PDW become more evident [21,22]. This probably explains the inconsistency in MPV and PDW values from our study.

Our findings support the concept of increased turn-over of platelets in pregnancy and a knowledge of these physiological changes is helpful in diagnosis and prognosis of super-imposed states of increased platelet consumption like pre-eclampsia, ectopic pregnancy, preterm labour, and the haemolysis elevated liver enzymes, and low platelet (HELLP) syndrome[21-24].

In this study, we have attempted to derive normal values (97.5% CI) for platelet count and platelet indices in apparently healthy pregnant women in Port Harcourt, but a longitudinal study will be required for more representative values.

V. Figures And Tables.

Table I: Mean, SD, µ-2SD, and µ+2SD for platelet parameters.

Parameter	Mean (µ)	SD	µ-SD	µ+SD
PLT (x 10^9/L)	212.7	63.3	86.9	340.0
MPV (fL)	9.99	1.94	6.11	13.87
PCT (%)	0.21	0.05	0.20	0.22
PDW (fL)	12.68	1.91	8.86	16.50

Table II: Distribution of platelet parameters across the trimesters.

Parameter	1st Trimester Mean (SD)	2nd Trimester Mean (SD)	3rd Trimester Mean (SD)
PLT (x10 9 /L	229.4 (61.2)	208.3 (66.4)	201.3 (65.2)
MPV (fL)	10.83 (1.06)	10.16 (1.19)	10.26 (1.16)
PCT (%)	0.27 (0.02)	0.20 (0.05)	0.20 (0.04)
PDW (fL)	13.06 (2.04)	12.69 (1.92)	12.48 (1.98)

Table III: Mean, SD, µ-2SD, and µ+2SD for platelet count and indices in pregnant and non-pregnant women.

Parameter		Mean (µ)	SD	µ-2SD	µ+2SD
PLT (x 10^9/L):	NP	234.75	62.29	110.17	359.33
	P	212.74	63.28	86.85	339.97
MPV (fL)	NP	8.93	1.05	6.83	11.03
	P	9.99	1.94	6.11	13.87
PCT (%)	NP	0.23	0.04	0.15	0.31
	P	0.21	0.05	0.11	0.31
PDW (fL)	NP	12.91	1.81	9.29	16.53
	P	12.68	1.91	8.86	16.50

Key: NP, Non-pregnant; P, Pregnant.

Table IV: Comparison of platelet parameters from our study with results of other studies.

Population	Instrument	PLT (x10^9/L)	MPV (fL)	PCT (%)	PDW (fL)	Ref.
This study	PCE 210 (N) ERMA	212.74 (63.28)	9.99 (1.94)	0.21 (0.05)	12.68 (1.91)	
Indian	Sysmex KX-21	218.4 (28.2)	8.63 (1.32)	-	11.02 (2.41)	12
Caucasian	Coulter Model S-Plus	-	8.7	-	12.0	21
Indian (28-32wks)	Sysmex K-1000	238 (56)	11.47 (1.36)	-	13.70 (0.64)	22
Turkish	Mindray BC-6800	228 (63.8)	9.73 (1.0)	-	16.12 (0.6)	23
Turkish	Mindray BC-6800	223.24 (68.19)	9.71 (1.47)	-	15.75 (1.03)	24

VI. Conclusion

Our study found lower platelet counts in pregnant women compared to non-pregnant women, platelets tend to decrease with increasing gestational age. PCT and PDW were also lower in pregnant women.. These findings support the concept of increased turn-over of platelets in pregnancy and a knowledge of these physiological changes is helpful in diagnosis and prognosis of super-imposed states of increased platelet consumption like pre-eclampsia, ectopic pregnancy, preterm labour, and the haemolysis elevated liver enzymes, and low platelet (HELLP) syndrome.

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