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Platelet Indices During Pregnancy in Enugu Women

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Abstract
Background: Following anaemia, thrombocytopenia a blood count below 150 x 10^9 cells /L is the next leading cause of blood disorders in pregnancy. Physiologically, low platelet count has been found to occur during normal pregnancy as a result of haemodilution, more consumption in peripheral tissue and increased aggregation. The aim of this study was to evaluate platelet indices of pregnant women attending antenatal at Enugu State University of Science and Technology Teaching Hospital. **Place and duration of study:** This case control study was conducted in the Department of Haematology, in collaboration with the Antenatal Unit of Enugu State University of Science and Technology Teaching Hospital during the period of May to October 2020.**Methodology**: Patients with 12 weeks' gestation and who are between the ages of 20-35years and attended at antenatal care unit were selected for the study. Blood samples were taken from patient at 12 weeks, 24 weeks and 36 weeks for platelet count and platelet indices. Platelet count and platelet indices were measured in automated haematology analyzer. **Results**:In this study, 3 (6.5%) of pregnant women had mild thrombocytopenia (100-<150 x 10^9 cells /L). The mean ± standard deviation of platelet count among pregnant women, 233.48 ± 69.32 was significantly lower compared with non-pregnant women, 307.40 ± 62.84 (p= < 0.001). While the mean ± standard deviation of mean platelet volume (MPV) and platelet-large cell ratio (PLCR) of pregnant women, 11.50 ± 0.44 and 33.09 ± 7.33 were significantly higher compared with non- pregnant women, 9.40 ± 0.35 and 25.30 ± 3.32 respectively (p= 0.002 and <0.001 respectively). However, no significant differences were found in the platelet count and platelet indices when the parameters were compared based on the trimester and age. Platelet count strongly correlated with plateletcrit (PCT) and platelet large cell coefficient (P-LCC) (<0.001). However, platelet count negatively correlated with mean platelet volume (MPV) and platelet distribution width. **Conclusion**: Based on this finding it can be concluded that there are mild thrombocytopenia, decreased platelet count, increased MPV and P-LCR in pregnant women compared to non-pregnant women.
key words, platelet, pregnant, women
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1. Introduction

When platelets are formed, they are discharged into the blood stream by precursor cells known as megakaryocytes that dwell within the bone marrow. Platelets are not only involved in haemostasis, thrombosis but also involved in other physiological and pathophsiological processes (van der Meijden & Heemskerk, 2019; Lefrancais *et al*, 2017). With Mean platelet volume (MPV) and Platelet-large cell ratio (P-LCR), platelet stimulation can be indirectly assessed. Mean platelet volume (MPV), which reflects the average size of platelet is a potential biological marker of platelet function (Leslie, 2010). Increase in MPV of Platelets makes platelets more active and prothrombotic and therefore more prone to platelet adhesion and aggregation (Sansanayudh *et al*, 2015 & Sansanayudh *et al*, 2014). Increased MPV had been being linked with several cardiovascular risk factors such as diabetes and hypertension (Klovaite *et al*, 2011; Braekkan *et al*, 2010) and is connected with a higher risk for both arterial and venous thrombosis (Levin & Bessman, 1983; Endler *et al*, 2002). However, it has been proven that there was an interrelationship between platelet number in the peripheral blood and the platelet volume with development of more modern coulter counters (Giles, 1981). Higher percentage of platelet larger cell ratio is observed in patients with hyperlipidaemia and suggests possible risk of thrombosis (Levin & Bessman, 1983). Thrombocytopenia is the second leading cause of blood disorders in pregnancy after anemia. It is seen in 7 to 10% of all pregnancies (Practice bulletin, 2016). In normal pregnancy, there is physiological decrease in platelet count due to haemodilution, higher consumption in peripheral tissue and increased aggregation (increased levels of thromboxane A2) (Jessica, 2018). Previous studies had shown that 5 to 10% of women who had uncomplicated pregnancies had a platelet count of less than 150 x10^9/l at the time of delivery (Reese *et al*, 2017; Abduljalil *et al*, 2012; Maymon *et al*, 2006), which was called gestational thrombocytopenia (Fogerty, 2018; Zhou *et al*, 2019).The normal platelet counts observed at the time of delivery and the absence of health problems in the mother and infant shows that gestational thrombocytopenia was the result of decrease platelet counts that occur in all women during pregnancy (Reese *et al*, 2018; Riera *et al*, 2020; Pandey,2017). The current study aimed to determine the platelet count and platelet indices of pregnant women from first trimester to the third trimester and also to correlate platelet count with platelet indices in pregnancy.

2. Materials and method: This was a case control study carried out in antenatal unit and haematology laboratory of Enugu State University of Science and Technology Teaching Hospital Enugu, Enugu State, Nigeria, for a period of 6 months. Forty six pregnant women in the age range of 20 and 35 years were recruited for the study. They were attending antenatal at antenatal care unit of the Enugu State University of Science and Technology Teaching Hospital. The approval for this study was given by the Research Ethics Committee of Enugu State University of Science and Technology Teaching Hospital (ESUTH) Enugu. Written informed consent was obtained from each pregnant woman. Those who were unable to sign inform consent form was excluded. Twenty five years age matched non-pregnant women were recruited as controls.

2.1 Sample collection

Three milliliters of blood samples were collected via venepuncture. Platelet count and platelet indices were analyzed by automated haematology analyzer (Mindray/BC-5150).

2.1.2 Statistical analysis: This was done using the SPSS version 21.0; means of variables are reported as mean ± standard deviation. Test of significant difference between means of variables was determined using the student "T" test, one way ANOVA and Pearson correlation coefficient. A value of ≤ 0.05 was considered significant.

3. Table 3.1 showed mean ± SD of platelet count and platelet indices of pregnant women and non-pregnant women. The platelet count of pregnant women (233.48 +/- 69.32 x 10^9/l) were significantly lower compared with non-pregnant women (307.40 +/- 62.84 x 10^9/l), ($p = <0.001$). While the mean platelet volume (11.50 ± 0.44 versus 9.40 ± 0.35 fl) and platelet large cell ratio (33.09 ± 7.33 versus 25.30 ± 3.32) were significantly higher in pregnant women compared to non-pregnant women respectively (p= 0.002 and <0.001 respectively).However, platelet distribution width, plateletcrit and platelet large cell coefficient are not significant

Table 3.1: Mean ± SD of platelet count and platelet indices of pregnant women and non–pregnant women

Parameters	test (N=46)	control (N=25)	p-value
Platelet count	233.48±69.32	307.40±62.84	<0.001*
MPV (fl)	11.50±0.44	9.40±0.35	0.002*
PDW (%)	16.40±0.28	16.39±0.29	0.953
PCT (%)	2.38±0.86	2.82±0.81	0.120
PLCC 10^3/µL	73.28±27.30	77.44±17.81	0.531
PLCR (%)	33.09±7.33	25.30±3.32	<0.001*

Table 3.2 compared platelet count and platelet indices of pregnant women across different age ranges. However, the result showed no significant difference in all of them.

Table 3.2: Mean ± SD of platelet count and platelet indices of pregnant women at age range of 20-24 (A), 25-30 (B) and 31-35 (C)

Parameters	Platelet count (x10^9/l)	MPV (fl)	PDW (%)	PCT (%)	P-LCC (10^3/µl)	PLCR (%)
A (N=5)	268.17±57.08	11.00±0.42	16.20±0.48	2.82±0.51	85.33±10.51	32.83±1.58
B (N=24)	237.69±50.94	10.72±0.97	16.09±0.52	2.54±0.80	79.37±31.25	30.67±6.90
C (N=17)	212.83±82.95	10.97±1.23	16.97±1.12	2.26±0.85	74.00±27.55	35.27±10.36
F (p) value	2.76 (0.07)	0.49 (0.61)	1.10 (0.14)	1.99 (0.15)	0.64 (0.53)	1.99 (0.15)
A vs B	0.26	0.43	0.94	0.40	0.65	0.29
A vs C	0.09	0.99	0.08	0.07	0.27	0.60
B vs C	0.50	0.76	0.11	0.50	0.82	0.24

Table 3.3 compared platelet count and platelet indices of pregnant women across the trimesters. However, the result showed no significant difference in all of them.

Table 3.3: Mean ± SD of platelet count and platelet indices of pregnant women at first trimester (FT), second trimester (ST) and third trimester (TT)

Parameters	Platelet count (x 10^9/l)	MPV (fl)	PDW (%)	PCT (%)	P-LCC (10^3/µl)	PLCR (%)
FT (n=13)	257.69±62.32	10.72±1.04	16.12±0.38	2.59±0.99	79.62±7.35	30.17±6.93
ST (n=16)	224.35±70.16	10.86±1.12	16.25±0.56	2.27±0.54	83.88±5.67	34.42±6.68
TT (n=17)	211.94±54.06	10.81±1.06	16.41±0.64	2.30±0.61	83.06±6.18	32.88±8.46
F (p) value	1.10(0.15)	0.06 (0.94)	1.04 (0.36)	0.83 (0.44)	1.77 (0.18)	1.90 (0.41)
FT vs ST	0.11	0.93	0.75	0.57	0.22	0.37
A vs C	0.37	0.97	0.29	0.64	0.38	0.61
BvsC	0.84	0.99	0.72	0.99	0.92	0.88

*Key=p<.05

Table 3.4 shows the correlation between platelet count and platelet indices. There was a strong positive

correlation between PCT, P-LCC and platelet count, which was significant (*P*=<0.001 and *P*=<0.001). However, MPV and PDW negatively correlated with platelet count (p=0.044 and 0.049 respectively).

Table 3.4: Pearson correlation coefficient between platelet count and platelet indices

Platelet indices	platelet count	
	r	p-value
MPV	-0.298	0.044*
PDW	-0.291	0.049*
PCT	0.843	<0.001**
P-LCC	0.654	<0.001**
P-LCR	0.045	0.769

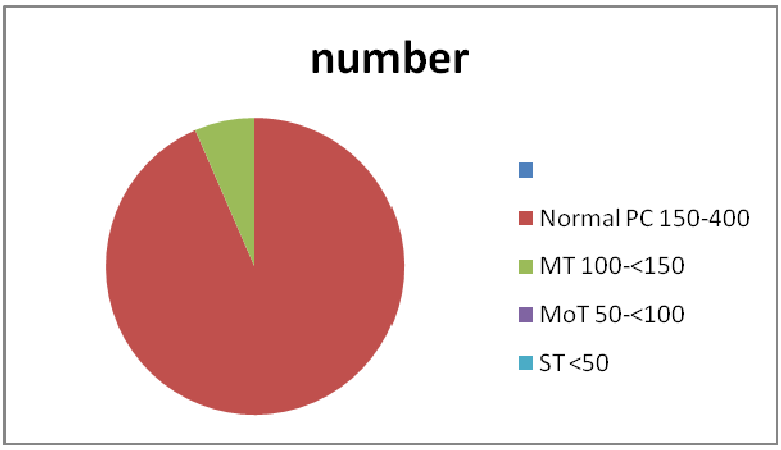

Fig 1: Incidence and severity of thrombocytopenia in pregnant women
Abbreviations: Normal PC= normal platelet count, MT=mild thrombocytopenia MoT= moderate thrombocytopenia, ST= severe thrombocytopenia

4. Discussion

Among the Enugu pregnant women studied, the mean platelet count was 233 x 10^9/L, which was lower than the mean platelet count in the non pregnant women (307 x 10^9/L). Then 6.5% of the women had platelet counts of less than 150 x 10^9/L. The wide gap between mean platelet counts of the pregnant women and also the non pregnant women may be due to multiple physiological changes that occur during pregnancy which may likely contribute to lower platelet counts in pregnant women. Lower platelet count in an uncomplicated pregnancy may be due to the plasma volume increase during pregnancy which is an obvious mechanism. This is the fundamentals for lower hemoglobin levels during pregnancy; which simply shows that red blood cells are diluted. And at same time platelets would have been be diluted too (Reese et al, 2018). There other mechanism that makes platelet count to be below 150 x 10^9/L during uncomplicated pregnancy and number one of them is that the placenta may accumulate platelets by pulling them out from the circulation. This process is similar to the role of the spleen in all normal individuals (Reese et al, 2018). Reduced platelet count observed in this study was also seen in the work of Reese et al., (2018). It has been suggested by some studies that MPV can be used for diagnostic purposes (Patrizia et al, 2016; Omar et al, 2018). Mean platelet volume test determines the average size of platelets. If the body produces more platelets, the average size of platelet usually increases. Mean platelet volume test can as well be used to assess the overall platelet function and activity. It can also be used to determine platelet production or destruction in bone marrow (Jonathan & Joseph, 2010). In this study increased levels of MPV and PLCR were found in pregnant women compared to non-pregnant women. This finding is consistent with the study done in Port Harcourt, Nigeria by Pughikumo et al., (2015). In this study platelet count negatively correlated with MPV and PDW which is in line with study by Feven et al., (2019) on role of platelet parameters in early detection and prediction of severity of preeclampsia.

5. Conclusion

This study demonstrated significant decrease in platelet count and increase in mean platelet volume and platelet large cell ratio. Also platelet count negatively correlated with mean platelet volume (MPV) and platelet distribution width. Based on this study, we recommend that simple biomarker (platelet indices) could be utilize by clinicians in developing countries such as Nigeria to manage patients (e.g pregnant women with or without complications) especially in this period of poor economic policies and high inflation rates.

Competing interests
Authors have declared that no competing interests exist

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