Platelet Indices among Sudanese Pregnant Women with Medical Disorders Association; A Cross-sectional Study in Port Sudan City

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Abstract: Pregnant women with medical disorders may associated with multiple changes in platelet indices parameters. It may be arising from hemodilution or increased platelet consumption during uteroplacental circulation. Platelet indices (PI) are a group of derived platelet parameters extracted as a part of the automatic complete hemogram. This study aimed to investigate the potential role of Platelets as a diagnostic or prognostic marker across the disease associated with Sudanese pregnancies. A cross-sectional study was conducted in March 2015 at Port Sudan Teaching Hospital, Port Sudan, Sudan. 40 Sudanese pregnant women with different medical complications were enrolled and 10 well pregnant women were included in this study. In both, platelet count (PLT), mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), platelet large cell ratio (P-LCR) and platelet cell concentration (P-LCC) were done. The pregnant women with medical association in compared with well pregnant women were found to be significant in the MPV, PDW, P-LCR, and P-LCC (P < 0.022, 0.036, 0.021 and 0.040 respectively). In contrast, PLT and PCT were found to be insignificant (P< 0.871 and 0.666). However, platelet indices were higher in patients than in controls except for the PLT and PCT level no changes were displayed. Accordingly, the convincing laboratory evidences in this study show that the usefulness of platelet indices as marker for medical disorders associated with pregnancy. The MPV and PDW are potential markers in the predicting disease severity.

Keyword: Platelet indices, MPV, PDW, Pregnant women, Port Sudan

1. Introduction

Platelets (thrombocytes) are a nucleated small discoid blood cells and considered a very high energy cell with metabolic rate 10 times that of an erythrocyte. It is originated from cytoplasmic fragments of bone marrow megakaryocyte, with a diameter of 1.5 – 3.5 µm and volume up to 10.4 fl (Turgeon, 2017; Budak, 2016). Each megakaryocyte giving rise approximately to 1000 – 5000 platelets into the circulation where they have 9.0 ± 1 day survival time (Hoffbrand, 2016). Platelet has an active role in the vascular integrity repair and primary hemostasis. Thrombopathy may involve in the pathogenesis of many medical disorders associated with pregnancy (Velera, 2010). Thrombocytopenia is generally common in pregnant women compared to non-pregnant women. Rarely, become lethal and increased the mortality (Dundar, 2008). The platelet indices, plateletcrit, mean platelet volume, platelet distribution width, platelet large cell ratio, and platelet large cell concentration are a group of platelet parameters related to platelet morphology and proliferation kinetics (Budak, 2016). These indices recently have been used in the diagnosis and prediction of a lot of the kind of disease as well as diseases associated with pregnancy, particularly in the evolution of pre-eclampsia (PE). A substantial study has demonstrated crucial roles for platelets in the pathogenesis of various clinical conditions (Thachil, 2015). Many researches have been found a relationship between the changes in the platelets indices and the disease associated with pregnancy (Pughikumo, 2015; Nooh et al, 2015). To date, there has been no studies or published data expressed the role of platelet indices in Sudanese pregnant women. This study aimed to investigate and summarized the

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potential role of platelet as diagnostic or prognostic marker among Sudanese women with medical disorders associated with pregnancy.

2. Materials and Methods

2.1 Study area and design

Forty Sudanese pregnant women with medical disorders associated attended to the Port Sudan Teaching Hospital, the Obstetric gynecology department along with 10 Sudanese well pregnant women as control were recruited into the study. They came to the hospital in different stages of trimesters. This was a cross-sectional study performed on March 2015.

2.2 Inclusion and exclusion criteria

Sudanese pregnant women who were ill, blood pressure ≥ 140/90 mmHg, major surgery, high blood glucose, renal impairment eligible to include in this study. The exclusion includes Sudanese pregnant women with active bleeding from any sites and with known myeloproliferative neoplasm or panmyelosis.

2.3 Study parameters and sample

The platelet indices were estimated by semi-automated hematology analyzer (URIT 3010, E02211 PR China) on 3 ml venous blood samples collected in di-potassium ethylene diamine acetic acid (K_2EDTA) according to the international council for standardization in hematology (ICSH) recommends.

The method of venipuncture and the degree of accuracy of filling and mixing the sampling tube already taken into account, so that it was done properly.

The specimens were analyzed within I hour from venesection to avoid the interaction when EDTA collected samples are analyzed.

2.4 Data analysis

Estimation of laboratory data platelet indices of pregnant women with medical disorders was presented as mean ± SD (standard deviation) and statistically tested by independent-sample t test and Pearson's Chi square test. P.value below 0.005 were considered significant. Data analyzed using a computer statistical package for social science (SPSS) software program version 24 (IBN, Chicago, USA).

2.5 Ethical considerations

This study was received ethical approval from Port Sudan Ahlia College, Hematology department and the Ministry of Health of Red Sea State. Written informed consent was obtained from all study participants.

2.6 Platelet indices definition

PI are group of platelet parameters determined together with automated complete blood count (CBC) profiles (Table 1).

Parameter	Description	Unit
PLT	Measure of the thrombocyte count	Microliter (μl)
MPV	Measure the thrombocytes volume	Femtoliter (fl)
PCT	The volume occupied by platelets in the blood	Percentage (%)
PDW	Indicator of variability in size and activation	Femtoliter (fl)
P-LCR	Indicator of large platelet in the blood	Percentage (%)
P-LCC	Indicator the concentration of circulating platelets	Percentage (%)

2.6.1 Mean platelet volume

It is the calculated measurement of the average size of platelet found in blood. The normal range is given as 7.5 – 10.4 fl (Larsen, 2014).

2.6.2 Platelet distribution width

Is an indicator of volume variability in platelet size, changes with platelet activation and reflects the heterogeneity in the thrombocyte morphology (anisocytosis). Normal rage given is 9 – 13 fl (Sachdev, 2014).

2.6.3 Plateletcrit

Is the volume (total platelet mass) occupied by platelets in the blood stream as a percentage. Volume of PCT varies depending on MPV and Platelet count according to the formula PCT= PLT x MPV/10.000 (Charadrashekar, 2013).

2.6.4 Platelet large cell ratio

Is an indicator of circulated large platelets in size (> 12 fl), sometimes used to monitor the platelet activity. It is presented in percentage of normal range 15 – 35% (Hong, 2014).

2.6.5 Platelet large cell concentration

Is the actual concentration of that large platelet in the total platelet count (Budak, 2016).

Results

Sudanese pregnant women that enrolled in this study were aged between 18 – 45 years (mean ±SD 29.9 ± 6.4). 7 (17.5%) of the women were in their first trimester, 18 (45%) in their second trimester, while 15 (37.5%) were in their third trimester. The well pregnant controls were aged between 20 – 33 years (mean ±SD 27.6 ± 4.3).

All patients (40) Sudanese pregnant women with medical disorders and (10) well pregnant women as control presented were screened for PLT, MPV, PCT, PDW, P-LCR, and PLCC levels. The pregnant women with medical association in compared with well pregnant women were found to be significant in the MPV, PDW, P-LCR, and P-LCC (P < 0.022, 0.036, 0.021 and 0.040 respectively). In contrast, PLT and PCT were found to be insignificant (P< 0.871 and 0.666) (Table 2).

However, platelet indices were higher in patients than in controls except for the PLT and PCT level no changes were displayed. A negative correlation was observed between MPV, PDW, PCT, P-LCR and P-LCC and the trimester stages (P < 0.445, 0.132, 0.355, 0.580 and 0.456 respectively). Figure 1 illustrates the overwhelming of platelet indices among trimester stages although the insignificancy.

The medical disorders associated with Sudanese pregnant women are summarized in (Table 3). It shows that diabetes mellitus (DM) represented the highest incidence (27.5%) of the disease associated with pregnancy. The MPV and PDW were significantly demonstrated high in pre-eclampsia (P < 0.008) which pointed to that indices are very potential marker in PE indicating the platelet activity. PDW gives an account in DM on the platelet activity (P < 0.016), but not the MPV (P < 0.089).

Table 2 Comparison of platelet indices between Sudanese pregnant women with medical disorders and well pregnant women

Parameter	Complicated pregnant women (n = 40) mean ± SD	Well pregnant women (n = 10) mean ± SD	P. value
PLT x 10^3/µl	240±74.5	244±23.8	0.871
PCT %	0.22±0.05	0.22±0.03	0.666
MPV fl	9.64±0.99	8.85±0.71	0.022*
PDW fl	12.91±2.5	11.1±0.97	0.036*
P-LCR %	23.9±7.3	18.1±4.6	0.021*
P-LCC %	54.4± 15.2	43.6± 10.8	0.040*

Table 3 List of medical diseases associated with Sudanese pregnant women

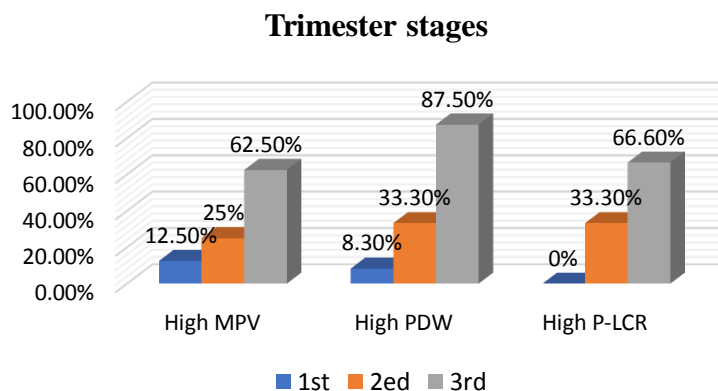| Disorders	Number (%)
PIH (Pregnancy induced hypertension)	9 (22.5%)
Pre-eclampsia (PE)	6 (15%)
Diabetes mellitus (DM)	11 (27.5%)
Abruptio placentae	2 (5.0%)
Toxoplasmosis	1 (2.5%)
Malaria	2 (5.0%)
Placenta previa	2 (5.0%)
HIV (Human immune virus)	5 (12.5%)
Hyperthyroidism	2 (5.0%)

Figure 1 Platelet indices during the trimester stages

Discussion

The measurement of all of the platelet indices simultaneously will provide a valid measure of disease severity as well as the new insight into the potential etiology in diagnosis and predicting that resulted in platelets indices changes.

In the present study, no changes in PLT and PCT were found in the Sudanese pregnant women with medical disorders and the Sudanese well pregnant women. These findings are similar to the study done in Ibadan, Nigeria by Obisesan et al, 1998. Our results highlight increasing MPV in the Sudanese pregnant women with medical disorders in compared to well pregnant women as a control ($P < 0.022$) which indicate increased in the platelet diameter and simultaneously pointed to the production rate and the platelet activation. Similar study reported are consistent with our results (Narcie et al, 2013).

High MPV also reported by Nooh et al, (2015) statistically significant in the pre-eclampsia than normotensive pregnant women ($P < 0.003$). The validity of alteration in the MPV in predicting pre-eclampsia has been extensively analyzed (Dundar et al, 2008). Many studies concluded that pregnant women with medical disorders with > MPV had an increased risk for developing pre-eclampsia (Jarmo et al, 2000). Moreover, they suggested that MPV stands as a potential marker for prediction of PE development (Jarmo et al, 2000).

A significant PDW increased was noted in our finding which is in agreement with those of previous studies (Yong, 2014; Freitas, 2013; Dadhish, 2012). Some conflicting finding has been published regarding the changes in the platelet indices in well pregnant women. Some researchers found no change in the values of these indices between patients and controls (Ceyhan, 2006, Freitas, 2013). Whereas others demonstrated difference in platelet index values (Yong, 2014; Dundar, 2008). This consistency of those studies may be due to the varying methods of platelet indices determination (Ceyhan, 2006).

P-LCR was significantly increased in patients with thrombocytopenia and decreased in thrombocytosis condition. It was inversely related to platelet count and directly related to MPV and PDW (Bobu, 2004). It was also being used in monitoring the platelet activation (Hong, 2014). Our study revealed high P-LCR and P-LCC (derived from PLT and P-LCR) which were consistent with some findings of the Brazilian study (Santos, 2004).

The clinical significance and usefulness of some of these platelet indices still need more studies. The present study has limitations that need to be taken into consideration. First, the restriction to the enrollment, patients admitted to Port Sudan Teaching Hospital. Second, the very limited number of medical disorders associated with pregnancy in this study. Regrettably, the platelet functions weren't performed in this study should be included in other studies.

Ultimately, the convincing laboratory evidences in this study show that the usefulness of platelet indices as marker for medical disorders associated with pregnancy. Abnormalities of increased MPV, PDW and P-LCR may suggest changes of platelet functions. The clinical uses of platelet indices, as markers of the disease spectrum. The MPV and PDW are potential markers in the predicting disease severity.

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