Platelet Parameters Assessment among Sudanese Pregnant Women with Preeclampsia Attending Wad Medani Obstetrics and Gynecology Teaching Hospital

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Abstract

Background: Preeclampsia is considered one of the major health problems associated with pregnancy and one of the causes of maternal mortality. The pathogenesis of preeclampsia associated with platelet activation.

Methods: This is a case-control laboratory-based study carried out in Wad Medani Obstetrics and Gynecology Teaching Hospital, Gezira State, Sudan from January to November 2020. The study aimed to evaluate the platelet parameters (platelet count and platelet indices) in pregnant women with preeclampsia. A total of 50 pregnant women with preeclampsia as cases (32.20 ± 3.21 years) and 50 normotensive pregnant women as controls (30.68 ± 2.85 years) participated in this study. Three ml of venous blood samples were collected from all participants in K_3 EDTA containers. platelet parameters (platelet count and platelet indices) were determined using Mindray BC 3000 Automated Hematology Analyzer. Data were analyzed using the SPSS computer program (version 22).

Results: The study results showed that the thrombocytopenia account for 56 %, all cases with low PCT (100%). Furthermore the means of PLTs count, PCT and PDW in cases were (144.40 ± 31.80 × 10^9/L, 0.13 ± 0.03 % and 15.80 ± 0.45 fl respectively) versus controls (269.40 ± 72.50 × 10^9/L, 0.22 ± 0.05 % and 15.50 ± 0.29 fl respectively), giving statistically significant differences (P value = 0.000, 0.003 and 0.022 respectively). The mean of PCT of mild cases was lower than severe cases (P value = 0.004); but there were no significant differences in PLTs count, MPV and PDW (P value = 0.379, 0.283 and 0.075 respectively).

Conclusion: The study concluded that platelet count (PLTs count) and plateletcrit (PCT) were significantly decreased in pregnant women with preeclampsia especially; so platelet parameters especially (PLTs count and PCT) should be included for assessing and predicting the risk of severe preeclampsia.

Introduction

Preeclampsia (PE) is a serious multi-systemic pregnancy complication affecting between 5–8 % of pregnant women worldwide [1]. Therefore it is considered as one of the major health problems associated with pregnancy and one of the causes of maternal mortality [2–3]. The prevalence of PE in developing countries ranges from 1.8–16.7% [4]. Preeclampsia has been a major cause of poor results in pregnancy and the category “hypertensive diseases of pregnancy” and is a leading cause of maternal death in Africa [5]. The pathogenesis of PE remains unknown, and the many theories related to the etiology of PE pose great challenges for future investigation. The abnormal invasion of the placenta and the release of placenta-derived adverse factors during the first trimester are thought to be the main cause of the extensive damage to the maternal endothelium and systemic inflammatory response involving many systems and organs in late pregnancy [6]. Although the causes of PE are completely unknown, one of the responsible mechanisms is thought to be the activation of inflammatory systems with predominant involvement of cytokines and chemokines. However, there is an ongoing debate about whether

inflammatory system hyperactivity indeed exists during PE and if available data are sufficient for justification of broad anti-immune system treatment strategies [7–8]. PE is characterized by hypertension (blood pressure > 140/90 mmHg), proteinuria (> 0.3 g/d), edema, and other symptoms and may begin as early as the 20th gestational week and last for 6 weeks after delivery [9].

Platelets are critical to normal homeostasis and help limit blood loss following vascular injury. In pregnancy, they become increasingly important in preventing excessive bleeding during and immediately following birth [10]. A growing body of evidence demonstrating that inflammation in microvasculature plays a major role in the pathogenesis of preeclampsia. Although circulating platelets are in a rested state, when they are exposed to soluble mediators or micro-particles in the inflamed vasculature as in preeclampsia, the platelet is activated by engagement of the mediators on surface receptors. Upon activation, the platelet degranulated some soluble and adhesion molecules [11]. Several studies suggested that when platelets were activated and become larger in size which causes increased platelet indices such as MPV, PDW, and PCT [12].

Methodology

The study was designed as a case-control laboratory-based study, carried out at Wad Medani Obstetrics and Gynecology Teaching Hospital, Gezira State, Sudan during the period from January to October 2020. The samples were collected randomly from 100 females (50 females with preeclampsia as cases and 50 normal healthy pregnant females as controls) according to inclusion and exclusion criteria.

All study procedures were approved by the Researches and Ethics Committees (REC) of the Ministry of Health, Gezira State and Faculty of Medical Laboratory Sciences, University of Gezira, Sudan. Informed consent was written from each participant.

A 2.5 ml venous blood sample was collected by clean venipuncture technique in K_2EDTA anticoagulant containers from each participant [13]. Thin blood film was prepared immediately. Platelet parameters (platelets count and indices) were measured using the Mindray BC 3000 Plus Cell Counter (Sysmex, Kobe, Japan). The platelet count was confirmed and assessed using stained thin blood film. The data were analyzed using a statistical package for social sciences (SPSS) computer program (Version 22.0).

Results

50 Sudanese females with preeclampsia (mean age 32.20 ± 3.21 years) and 50 normal healthy pregnant Sudanese females (mean age 30.68 ± 2.85 years) participated in this study. Most cases in age group more than 30 years (58 %), Most cases in the third trimester of pregnancy (76 %) and had no family history of preeclampsia (72 %); 50 % of cases had severe preeclampsia (Table 1).

Table 1
Demographic characteristics of study participants.

Factors	Cases (N = 50)	Control (N = 50)
Age (years) (Mean ± SD)	32.20 ± 3.21	30.68 ± 2.85
Age group (years)	22 (44 %)	27 (54 %)
≤ 30 years	28 (58 %)	23 (46 %)
< 30 years		
Weight	71.10 ± 5.70	67.84 ± 5.63
Trimester	12 (24 %)	5 (10 %)
Second	38 (76 %)	45 (90 %)
Third		
Preeclampsia severity	25 (50 %)	
Mild	25 (50 %)	
Severe		
Family history	14 (28 %)	
Yes	36 (72 %)	
No		

On the other hand, thrombocytopenia accounts for 56 %, all cases with low PCT (100%), most cases with normal MPV (98%), and PDW (100%) (Fig. 1).

The means of PLTs count, PCT and PDW in cases were (144.40 ± 31.80 × 10^9/L, 0.13 ± 0.03 % and 15.80 ± 0.45 fl respectively) versus controls (269.40 ± 72.50 × 10^9/L, 0.22 ± 0.05 % and 15.50 ± 0.29 fl respectively), giving statistically significant differences (P value = 0.000, 0.003 and 0.022 respectively); while there was no significant difference in MPV between them (P value 0.884) (Table 2).

Table 2
Comparison of platelet parameters between cases and control.

Parameters	Cases (N = 50) (Mean ± SD)	Controls (N = 50) (Mean ± SD)	P value *
PLTs count × 10^9/L	144.40 ± 31.80	269.40 ± 72.50	**0.000**
PCT %	0.13 ± 0.03	0.22 ± 0.05	**0.003**
MPV fl	9.30 ± 0.70	8.30 ± 0.72	0.884
PDW fl	15.80 ± 0.45	15.50 ± 0.29	**0.022**

The mean of PCT of mild cases was (0.15 ± 0.02 %) versus controls (0.12 ± 0.03 %) (P value = 0.004); but there were no significant differences in PLTs count, MPV and PDW (P value = 0.379, 0.283 and 0.075 respectively) (Table 3).

Table 3
Comparison of platelet parameters between Mild and severe preeclampsia.

Parameters	Mild (N = 25) (Mean ± SD)	Severe (N = 25) (Mean ± SD)	P value *
PLTs count × 10^9/L	166.60 ± 18.30	122.30 ± 26.80	0.379
PCT %	0.15 ± 0.02	0.12 ± 0.03	**0.004**
MPV fl	9.05 ± 0.70	9.70 ± 0.55	0.283
PDW fl	15.70 ± 0.34	16.00 ± 0.50	0.075

There were no significant differences in PLTs count, PCT, MPV and PDW between trimester among cases (P value = 0.588, 0.171, 0.185 and 0.414 respectively) (Table 4).

Table 4
Comparison of platelet parameters between second and third trimesters.

Parameters	2nd trimester (N = 12) (Mean ± SD)	3rd trimester (N = 38) (Mean ± SD)	P value *
PLTs count × 10^9/L	149.80 ± 26.80	142.70 ± 33.40	0.588
PCT %	0.14 ± 0.02	0.13 ± 0.03	0.171
MPV fl	9.30 ± 0.82	9.30 ± 0.68	0.185
PDW fl	15.80 ± 0.41	15.90 ± 0.46	0.414

Discussion

Preeclampsia (PE) is a multisystem disorder of unknown cause, it is characterized by the abnormal vascular response that is associated with increased systemic vascular resistance, enhanced platelet aggregation, activation of the coagulation system, and endothelial cell dysfunction [6]. Complete blood count (CBC) parameters including platelet count and platelet indices such as MPV, PDW, and PCT are widely available and are less cost-effective. However, in daily practice, most physicians consider only CBC parameters thus neglecting other parameters like platelet indices [14].

This is a case-control laboratory-based study carried out in Wad Medani Obstetrics and Gynecology Teaching Hospital, Gezira State, Sudan from January to October 2020 to evaluate the platelet count and platelet indices (MPV, PCT, and PDW) among preeclamptic women. 50 Sudanese pregnant women with

preeclampsia (mean age 32.20 ± 3.21 years) and 50 normal healthy pregnant women (mean age 30.68 ± 2.85 years) were randomly selected according to inclusion and exclusion criteria.

The study results showed there were significant differences between cases and controls in platelets count (P value = 0.000), PDW (P value = 0.022), and PCT (P value = 0.003). This study results similar to studies done in the United Kingdom [15], Egypt [16], India [17–18], Brazil in 2013 stated that Lower PLT count and PCT were observed in PE compared to normal pregnant and to non-pregnant women with P value < 0.001 [19], and in Sudan that revealed that among 87 total pregnant women, 37 were pre-eclamptic pregnant women, and there were significant differences in the platelets indices of MPV, PDW, and PCT among the study group [20]. The preeclampsia-associated vascular changes which lead to platelet consumption in the repair of vessel damage, contact of platelets with the injured endothelium activates the coagulation system, which can increase both consumption and bone marrow production of platelet, enhance thrombopoiesis produce younger platelet which is larger than older platelet. There was a slight increase in the mean MPV of cases but not a significant difference when compared with the cases (P value = 0.283). This result agrees with the study done in Egypt by Ahmed *et al*., [16]. There was a slight increase in means MPV and PDW of cases, this result consistent with the study done by Kaito *et al*., and suggested causes due to hyper-destruction of platelet increases MPV and PDW because the younger platelet was larger than old platelet which leads to increase in MPV [14]. The study results disagree with a study done in Turkey which found no significant differences between patients with preeclampsia and healthy pregnant, which take 50 cases and 50 controls and compare between them [21]. There was a significant difference between mild and severe preeclampsia in PCT (P value = 0.004) due to lower platelet count in severe preeclampsia more than mild preeclampsia, but there were no significant differences in PLT count, MPV, and PDW. Sontas *et al*, revealed that PCT was found to be associated with the severity of PE when it was compared with mild stage [22]. This study disagrees with a study done by Yayuzcan *et al*, that reported PCT was no difference between mild and severe PS [21] and agrees with Neiger and Contag observed no significant difference in platelet count between mild and severe pre-eclamptic cases [15]. There were no significant differences in platelet parameters according to trimester.

Conclusion

The study concluded that platelet count (PLTs count) and plateletcrit (PCT) were significantly decreased in pregnant women with preeclampsia especially; so platelet parameters especially (PLTs count and PCT) should be included for assessing and predicting of the risk of severe preeclampsia.

Abbreviations

PCT: Plateletcrit; PLTs: Platelet; PDW: Platelet Distribution Width; MPV: Mean Platelet Volume; PE: Preeclampsia; REC: Researches and Ethics Committees; SPSS: Statistical Package for Social Sciences; CBC: Complete Blood Count.

Declarations

Acknowledgment:

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Authors' contributions:

Ejlal Omer FadlElseed designed and did data collection. Ejlal Omer FadlElseed, Khalid Abdelsamea Mohamedahmed, Aboagala Mustafa Mohamed, Muatez Ibrahim Hassan did the writing of the original draft. Yousif E/Hameed Mohammed participated in the statistical analysis of the data. Khalid Abdelsamea Mohamedahmed and Albadawi Abdebagi Talha did the editing and review of the original article.

Ethics approval and consent to participate:

We researched the Declaration of Helsinki, and the protocol was approved by Researches and Ethics Committees (REC) of the Ministry of Health, Gezira State and Faculty of Medical Laboratory Sciences, University of Gezira, Sudan.

Competing interests:

The authors have declared that no competing interests exist.

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Figures

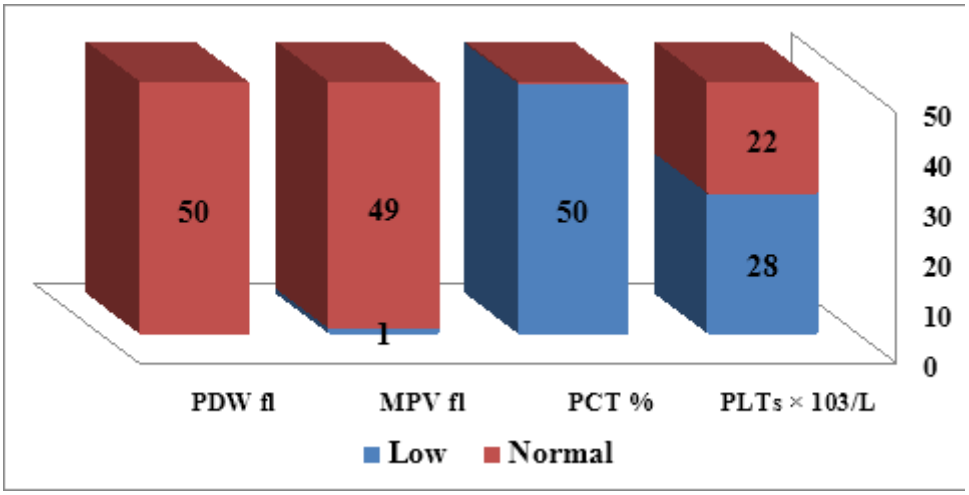

Figure 1

Frequency of platelet parameters among cases.