Platelets changes in pregnancy as a prognostic factor in preeclampsia and intra uterine growth restriction (IUGR)

Prof. Dr. Khaled Zakaria El Sheikha[1], Prof. Dr. Abdel Monsef Abdel Hameed Seddek[1], Dr. Abdel Raouf Abdel Raouf Abo Nar[2] and Mohamed El Demerdash El Hawary[1]

[1]Department of Obstetrics & Gynecology, Faculty of Medicine, Al-Azhar University, Cairo, Egypt
[2]Department of Clinical Pathology, Faculty of Medicine, Al-Azhar University, Cairo, Egypt
Mhawary101@gmail.com

Abstract: The purpose of this study was to evaluate the changes in platelets indices and their significance in assessment of severity of preeclampsia and their correlation with pregnancy outcome, the estimation of platelet indices method can be considered as an early, economical, rapid and useful screening test for early identification of preeclampsia and eclampsia. Also platelet indices can assess the prognosis of preeclampsia in pregnant women. Thus platelet indices can have a significant impact on maternal and perinatal outcome. With sever preeclampsia there are decreased platelet count and increased MPV, PDW and PLcr. A significant decrease in platelet number was observed as the mean blood pressure increased. The increase in MPV in preeclampsia and eclampsia probably indicate hyperdestruction of platelets due to shorter half-life. Increased PDW reflects increased platelet turnover which would support the idea that platelet survival time is decreased resulting in increased destruction of platelets. Increased PLcr suggests increased bone marrow activity.

[Khaled Zakaria El Sheikha, Abdel Monsef Abdel Hameed Seddek, Abdel Raouf Abdel Raouf Abo Nar and Mohamed El Demerdash El Hawary. **Platelets changes in pregnancy as a prognostic factor in preeclampsia and intra uterine growth restriction (IUGR).** *Nat Sci* 2017;15(9):8-11]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). http://www.sciencepub.net/nature. 2. doi:10.7537/marsnsj150917.02.

Key words: Preeclampsia, platelet indices, platelet count, mean platelet volume, platelet distribution width, platelet large cell ratio and intra uterine growth restriction.

1. Introduction:

Preeclampsia is a disorder of widespread vascular endothelial malfunction and vasospasm that occurs after 20 weeks' gestation. It is clinically defined by hypertension and proteinuria, with or without pathological edema **(lim and Ramus, 2011).**

Where hypertension is diagnosed when blood pressure 140/90 mm Hg and proteinuria is diagnosed when proteinuria 300mg/24hours urine (**Alexander, et al, 2006**).

Severe preeclampsia is defined as in the presence of preeclampsia: Systolic blood pressure of 160 mmHg or higher or diastolic blood pressure of 110 mmHg or higher on 2 occasions at least 6 hours apart plus the presence of 1 or more of the following symptoms or signs, proteinuria of 3gm in 24 hour collection, pulmonary edema or cyanosis, oliguria 400 ml in 24 h, persistent headache, epigastric pain and / or impaired liver function, thrombocytopenia, oligohydraminos, decreased fetal growth or placental abruption (**Lindhaimer, et al, 2008$_b$**).

Preeclampsia is one of the most important causes of maternal and fetal morbidity and mortality. Many theories are proposed for the pathophysiology of pre-eclampsia. The formation of a utero placental vasculature insufficient to supply adequate blood to the developing fetus results in fetoplacental hypoxia, leading to imbalances in the release and metabolism of prostaglandins, endothelin and nitric oxide by placental and extra placental tissues. As well as enhanced lipid peroxidation and other undefined factors contribute to the hypertension, platelet activation and systemic endothelial dysfunction characteristics of preeclampsia. Activationof coagulation system in small vessels and increased platelet aggregation is present in preeclampsia. It is clear that preeclampsia is one of the causes of maternal thrombocytopenia and the platelet count increases rapidly after the delivery. There are studies suggesting the storage of platelet in the areas with endothelial damage as the cause of thrombocytopenia. The platelet counts were lower, while the mean platelet volume, platelet distribution width and platelet large cell ratio were increased in preeclampsia as compared to control group **(Annam, et al, 2011).**

The estimation of platelet indices method can be considered as an early, economical and rapid procedure of assessment of severity of preeclampsia. Clinically platelet indices can be a useful screening test for early identification of preeclampsia. Also platelet indices can assess the prognosis of the disease in pregnant women. Thus platelet indices can have a significant impact on maternal and perinatal outcome (**Annam, et al, 2011).**

2. Patients and methods:

The present study was a comparative observational prospective study that was done from February 2016 to March 2017 in El-Mahalla general hospital and El-Sayed Galal university hospital and comprised (200) pregnant women who were divided into two groups:

1-100 normotensive.

2-100 with preeclampsia. (68 cases were mild preeclampsia and 32 cases were sever preeclampsia).

Blood samples were analyzed for platelet indices (platelet count, mean platelet volume (MPV), platelet distribution width (PDW) and platelet large cell ratio (PLcr) by automated hematology analyzer (Sysmex–Japan – 2008 – error % 1:2 %).

Follow up:

All women will be followed up every 4 weeks until 32 weeks then every 2 weeks until 36 weeks and finally weekly until delivery, for pregnancy outcome as regard: maternal morbidity and mortality, fetal Apgar score, weight and if needed incubator or not and neonatal mortality.

3. Results:

This study included 2 groups of pregnant women: first group included 100 pregnant women with normal blood pressure and second group included 100 pregnant women with preeclampsia, 68 cases of second group were mild preeclampsia and 32 cases of second group were sever preeclampsia.

Table (1): Demographic data of the 3 groups (normotensive pregnant women, mild preeclampsia and sever preeclampsia cases):

Demographic data	Normotensive pregnant women (n=100)	Mild preeclampsia cases (n=68)	Sever preeclampsia cases (n=32)	P value
Age (years) Mean ± SD	25.5 ± 3.0	28.8 ± 24.3	25.7 ± 3.4	> 0.05
Gravidity Mean ± SD	2.6 ± 1.6	2.5 ± 1.4	3.3 ± 2.1	> 0.05
Parity Mean ± SD	1.48 ± 1.43	1.38 ± 1.29	1.75 ± 1.74	> 0.05
BMI (Kg / m^2) Mean ± SD	32.08 ± 0.5	32.6 ± 0.8	34.9 ± 1.4	< 0.05

This table (1) showed that BMI increased with severity of preeclampsia (P < 0.05). While age, gravidity and parity were non significant between groups (P > 0.05).

Table (2): Comparison of platelet indices among 3 groups (normotensive pregnant women, mild preeclampsia and sever preeclampsia cases):

Platelet indices	Normotensive pregnant women (n=100)	Mild preeclampsia cases (n=68)	Sever preeclampsia cases (n=32)	P value
PLT count (/mm^3) Mean ± SD	252,600 ± 45,715	183,850 ± 38,002	134,880 ± 34,005	< 0.05
MPV (fl) Mean ± SD	8.522 ± 0.8555	9.843 ± 0.7008	11.294 ± 1.1714	< 0.05
PDW (fl) Mean ± SD	11.091 ± 2.0476	14.296 ± 1.8800	17.394 ± 2.1378	< 0.05
PLcr (%) Mean ± SD	17.15 ± 4.453	25.02 ± 4.689	31.93 ± 4.645	< 0.05

This table (2) showed that platelet count decreased with severity of preeclampsia, while MPV, PDW and PLcr increased with severity of preeclampsia.

Table (3): Comparison of neonatal outcome between normotensive pregnant women, mild preeclampsia and sever preeclampsia cases:

Group Variable	Normotensive pregnant women (n=100)	Mild preeclampsia (n=68)	Sever preeclampsia (n=32)	P value
Apgar-1 Mean ± SD	5.20 ± 1.181	4.93 ± 1.250	4.13 ± 2.268	< 0.05
Apgar-5 Mean ± SD	7.98 ± 1.025	7.91 ± 1.368	6.44 ± 2.526	< 0.05
Newborn birth weight (kg) Mean ± SD	3.157 ± 0.2992	2.860 ± 0.3391	2.597 ± 0.4618	< 0.05
Gestational age (GA) by (week) Mean ± SD	38.8 ± 1.8	36.5 ± 2.0	34.7 ± 1.4	< 0.05

This table (3) showed that the Apgar-1, Apgar-5, newborn birth weight and GA were significantly higher in normotensive women.

4. Discussion:

Preeclampsia is a multisystem disorder of unknown cause, It is characterised by abnormal vascular response to placentation that is associated with increased systemic vascular resistance, enhanced platelet aggregation, activation of the coagulation system and endothelial cell dysfunction. **(Sibai, et al, 2005).**

In this study an attempt has been made to assess the role of platelet indices in assessment of severity of preeclampsia and their correlation with pregnancy outcome.

The present study was a prospective study that was done from february 2016 to March 2017 in El-Mahalla general hospital and El-Sayed Galal university hospital and comprised (200) pregnant women who were divided into two groups: 100 normotensive and 100 with preeclampsia (68 cases were mild preeclampsia and 32 cases were sever preeclampsia).

There was a significant difference between the 3 studied groups as regards the BMI which increased with severity of preeclampsia ($P < 0.05$) and the GA which was significantly higher in normotensive women ($P < 0.05$). While there was no significant difference between groups as regards age, gravidity and parity ($P > 0.05$).

In the present study severity of preeclampsia and thrombocytopenia observed are closely correlated which indicates that thrombocytopenia is directly proportional to the severity of preeclampsia. The platelet count values in the present study were: normotensive pregnant women (252,600 ±45,715 / $mm^{3)}$, mild preeclampsia (183,850 ± 38,002 / $mm^{3)}$, and sever preeclampsia (134,880 ± 34,005 / mm^3). So PLT count decreased with severity of preeclampsia. The P values here were less than 0.05 so it was considered statistically significant. So in cases with preeclampsia when PLT count was ≤ 168,000 / mm^3, it suggested severity of preeclampsia.

This agreed with the results reported by Dube **et al (1975), Mohapatra et al (2007), Annam et al (2011), Dadhich et al (2012), Freitas et al (2013) and Mohamed et al (2013).**

In the present study there is a gradual increase in MPV from normotensive pregnant women (8.5 ± 0.8 fl) to mild preeclampsia (9.8 ± 0.7 fl) and sever preeclampsia (11.2 ± 1.1 fl). So MPV increased with severity of preeclampsia. The P values here were less than 0.05 so it was considered statistically significant. So in cases with preeclampsia when MPV was ≥ 10.3 fl, it suggested severity of preeclampsia. This increase in MPV in sever preeclampsia probably indicate hyperdestruction of platelets due to shorter platelet half life **(Annam, et al, 2011)**.

The results of this study were in agreement with that reported by **Ahmed et al (1993), Santos and Filho (2004), Annam et al (2011)**, **Dadhich et al (2012), Freitas et al (2013) and Mohamed et al (2013)**.

In the present study there is a gradual increase in PDW from normotensive pregnant women (11.09 ± 2.04 fl) to mild preeclampsia (14.29 ± 1.8 fl) and sever preeclampsia (17.39 ± 2.1 fl). So PDW increased with severity of preeclampsia. The P values here were less than 0.05 so it was considered statistically significant. So in cases with preeclampsia when PDW was ≥ 16.2 fl, it suggested severity of preeclampsia. This increase in PDW in sever preeclampsia probably reflects increased platelet turnover which would support the idea that platelet survival time is decreased resulting in increased destruction of platelets **(Annam, et al, 2011).**

These results were in agreement with that reported by **Santos and Filho (2004), Annam et al (2011), Dadhich et al (2012), Freitas et al (2013) and Mohamed et al (2013)**.

In the present study there is a gradual increase in PLcr from normotensive pregnant women (17.15 ± 4.45 %), to mild preeclampsia (25.02 ± 4.68 %) and sever preeclampsia (31.93 ± 4.64 %). So PLcr increased with severity of preeclampsia. The P values here were less than 0.05 so it was considered statistically significant. So in cases with preeclampsia when PLcr was ≥ 29.7 %, it suggested severity of preeclampsia. This increase in PLcr in sever preeclampsia suggests increased bone marrow activity **(Annam, et al, 2011)**. The results of this study agreed with that reported by **Santos and Filho (2004) and Annam et al, (2011).**

Thus increase in MPV, PDW, PLcr may form basis for prediction of severity of preeclampsia in pregnancy.

In the present study we found that there was relationship between platelet indices in sever preeclampsia and pregnancy outcome, where in sever preeclampsia when (platelet count was low, MPV was high, PDW was high and PLcr was high) these associated with bad pregnancy outcome (on mother and fetus). In this study sever preeclampsia cases with poor maternal prognosis were complicated by eclampsia, death from brain insult, pulmonary oedema, reversible acute tubular necrosis and HELLP syndrome. While Poor neonatal prognosis in sever preeclampsia cases was in neonates needed NICU, Apgar-5 < 7 and neonatal mortality.

Thus the PLT count decreased and the (MPV, PDW, PLcr) increased with the severity of preeclampsia, poor maternal prognosis and poor fetal prognosis. So the estimation of platelet indices can be

considered as an early, economical and rapid procedure of assessment of severity of preeclampsia. Also platelet indices can assess the prognosis of the preeclampsia in pregnant women.

Conclusion:

Finally to conclude, that the estimation of platelet changes can be considered as an early, economical and rapid procedure of assessment of severity of preeclampsia. Also platelet changes can assess the prognosis of preeclampsia in pregnant women and can have significant impact on maternal and perinatal outcome.

References:

1. Ahmed Y., Iddeking B.V., Paul C., et al (1993): Retrospective analysis of platelet numbers and volumes in normal pregnancy and in preeclampsia, British Journal of Obstetrics and Gynaecology, (100), 216-220.
2. Alexander JM, Mclntire DD, Leveno KJ, et al (2006): Selective magnesium sulfate prophylaxis for the prevention of eclampsia in women with gestational hypertension. Obstet Gynecol 108: 826.
3. Annam V., Srinivasa K, Yatnatti S.K., et al (2011): Evaluation of platelet indices and platelet counts and their significance in preeclampsia and eclampsia, Int J Biol Med Res., 2 (1): 425-8.
4. Dadhich S., Agrawal S., Soni M., et al (2012): Predictive value of platelet indices in development of preeclampsia, Journal of south Asian Federation of Obstetrics and Gynaecology, 4 (1); 17-21.
5. Freitas LG, Alpoim PN, Komatsuzaki F, et al (2013): Preeclampsia: are platelet count and indices useful for its prognostic. Hematology. 18(6): 360-4.
6. Lim K.H. and Ramus R.M. (2011): Preeclampsia, emedicine-medscape.com, article 1476919.
7. Lindheimer MD, Taler SJ and Cunningham FG (2008b): Hypertension in pregnancy (Invited Am Soc Hypertension Position Paper). J Am Soc Hypertens 2: 484.
8. Mohammed F.E., Khalil H.B., Idriss M.I., et al (2013): Variations of platelets indices in pregnancy induced hypertension. J Physiobiochem Metab 2: 1. doi:10.4172/2324-8793.1000106.
9. Mohapatra S., Pradhan BB., Satpathy UK, et al (2007): Platelet estimation: Its prognostic value in pregnancy induced hypertension, Ind J Physiol Pharmacol, 51 (2): 160-164.
10. Santos E.V. and Filho J.M. (2004); Measurement of platelet parameters in normal and preeclamptic pregnant women, Rev. Bras. Ginecol. Obstet., (26), (n. 3), 201-206.
11. Sibai BM (2005): Diagnosis, prevention and management of eclampsia. Obstet Gynecol 105: 402.

7/9/2017