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PLATELET INDICIES (MPW AND PDW) IN TERM, PRETERM AND SMALL FOR GESTATIONAL AGE NEONATES

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ABSTRACT **OBJECTIVE:** To evaluate the immediate postnatal values of the platelet indices (MPV and PDW) in healthy neonates of different gestational ages. METHOD: The MPV and PDW values identified in the first three days of life in 55 consecutively born healthy term (22), preterm (19) and small for gestational age (SGA) neonates (14) admitted in the NICU of a tertiary care teaching hospital in Tumkur, were collated, compared and statistically analysed to determine if prematurity and intrauterine growth retardation had any effect on these parameters. **RESULTS:** MPV and PDW values of preterm and SGA when compared to the values in term neonates were found to be significantly higher (p=0.009 and p = 0.004 respectively). **CONCLUSION**: Mean platelet volume and platelet distribution width were significantly increased in healthy premature and SGA new born possibly as a result of physiological stress induced platelet activation. This needs to be considered when platelet indices are used as surrogate markers for the early diagnosis of significant and severe disease of the new born such as early onset neonatal sepsis, thrombosis and others

KEYWORDS : Term, preterm, SGA neonates, MPV, PDW

AIM: To assess the MPV and PDW in healthy neonates of different gestational ages in the first three days of life

OBJECTIVE: To compare statistically, the platelet indices (MPV and PDW) in healthy preterm, SGA and term neonates in the first three days of life.

INTRODUCTION

Haemostasis in the new born is a dynamic entity that gradually develops during foetal life and early infancy ([1,2]). Haemostatic mechanisms are influenced by the physiological state of the new born (term gestation, prematurity, intrauterine growth retardation) as well as by external influences (birth asphyxia, sepsis) and a myriad of other neonatal conditions. [3,4] Platelet activation, aggregation and adhesion play a crucial role in the haemostatic mechanism and the platelet count along with platelet indices (a reflection of platelet activation) reflects the adequacy of the platelet response. However, the platelet count by itself does not provide a complete picture of the haemostatic response as is evident by the persistence of bleeding or the propensity for thrombosis despite counts being within the normal ranges for age in many instances. The platelet indices (MPV and PDW) are a reflection of platelet activation which in turn is an indirect marker of platelet function and maturity. An increase in the MPV and PDW reflects the presence of larger and younger platelets which are enzymatically and metabolically more active than smaller aged platelets and while their response to haemostatic challenges are more robust, there is also an inherent risk of thrombosis due to enhanced platelet swelling and pseudopodia formation during activation. Therefore, platelet indices may be useful as early diagnostic markers for a number of conditions that affect the haemostatic mechanisms of the body.[5] Platelet indices have been extensively studied in many pathological conditions such as diabetes, coronary artery diseases, angina, pulmonary tuberculosis and iron deficiency anaemia in adults, but their role in neonatal disorders has not been firmly established [6-9]. This is largely due to the difficulty in collecting adequate samples from very small babies for analysis as well as the lack of sufficient data on the normal values of these indices in different gestational ages. Automated analysers have now made it possible to measure the platelet indices precisely and quickly from very limited sample volumes but the inadequacy of data remains a problem. This study was conducted to evaluate the platelet indices – both MPV and PDW in preterm and small for gestational age neonates and compare them with those from term (appropriate for gestational age) babies.

MATERIALS AND METHODS

This was a prospective case control study on healthy new born babies serially delivered in our hospital from Oct 2022 to Dec 2022 and followed up for 72 hours after birth. A detailed history regarding antenatal check-ups in mother, mode of delivery, antenatal risk factors (maternal diabetes, pre-ecclampsia, hypo-thyroidism) and drugs affecting platelet function administered within 10 days prior to delivery, was noted. The gestational age was calculated from the date of last menstrual period, in concordance with the new Ballard Score. Neonates with gestational ages between 25 and 32 weeks, weighing 1000-2150g were considered preterm. New born with gestational ages between 38 and 41 weeks and weighing less than the 10th percentile for age were considered as SGA. New born with gestational ages between 37 and 42 weeks and weighing 2500 - 3900g were considered as full-term AGA neonates. After obtaining informed written consent from parents, venous blood samples from 55 neonates was collected in ethylene diamine tetra acetic acid (EDTA) within 72 hours of birth. All samples were analysed using the same Pentra ES 60 (® Horiba, Japan) auto-analyser. The MPV (mean platelet volume) and PDW (platelet distribution width) were studied in detail. **Inclusion criteria**: Samples collected within 72 hrs of birth from healthy full term appropriate for gestational age, preterm and SGA neonates who were admitted purely for observation or for physiological jaundice. **Exclusion Criteria**: Samples collected from neonates after 72 hr of birth or neonates with clinical and/or laboratory evidence of infection or those with major congenital anomalies or with the history of birth asphyxia as well as those born to mothers with significant antenatal disease (diabetes, pre-ecclampsia) or those administered drugs involving platelet numbers or function were excluded from the study. Statistical analysis was performed on the collected data using the SPSS software. Ethical clearance was obtained from the Ethics Committee of the institution.

Results:

A total of 55 new born delivered during the study period were included in the present study of which 14 were SGA, 19 full term and 22 preterm neonates. The average MPV of preterm and SGA neonates (8.35fL and 7.83fL respectively) was significantly higher when compared with term neonates (7.7fL), p-value = 0.009. The PDW was also significantly increased in preterm and SGA neonates (15.34fL, 14.08fL respectively) when compared with term neonates (13.68fL), p-value = 0.004. The graphical representation of mean platelet volume and platelet distribution width are shown in figures below.

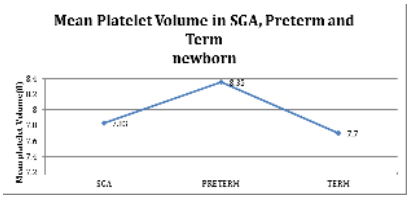

Fig-1: Average mean platelet volume in SGA, preterm, term new born

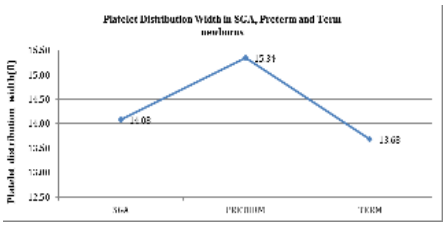

Fig-2: Average mean platelet distribution width in SGA, preterm, term neonates

Table-1: Platelet indices in term, preterm, SGA neonates

PLATELET INDICES	TERM	PRETERM	SMALL FOR GESTATIONAL AGE	F-test	P-VALUE
Mean platelet volume(fl)	7.716±0.683	8.187±0.918	7.839±0.712	1.114	0.009
Platelet distribution width(fl)	13.774±2.044	14.549±3.048	13.909±2.183	0.368	0.004

DISCUSSION:

The PDW reflects the variability in platelet size often seen in association with a number of disorders and rises when younger platelets predominate in the sample. The normal range in a term new born is between 7 and 9 fL which remains remarkably constant throughout life, unless challenged. However, alterations in the physiological milieu in preterm and small for gestational age neonates has been noted in some earlier studies (10,11,12) to cause variations in the platelet indices. In our study, the MPV and PDW were found to be significantly higher in preterm and SGA infants than in term infants. Wasiluk et al (2016) 13 found similar results in their study on 129 term, preterm and SGA new born. While external factors like infection or drugs may certainly affect the platelet indices in sick new born, the difference in our study on healthy neonates probably reflects the release of more young and activated platelets from the bone marrow in response to internal stress. Kannar et al (2014) 5 while reflecting similar findings in their study, also demonstrated that both MPV and PDW increase simultaneously but in inverse proportion to the platelet count..

Table-2: Comparison of platelet indices in SGA:

PLATELET INDICES	PRESENT STUDY	KANNAR et al	WASILUK et al
1.Mean platelet volume (fL)	7.839±0.712	8.16±0.64	8.25±0.8
2. Platelet distribution width	13.909±2.183	14.10±2.93fL	47.0±10.33 %

Table -3 : Comparison of platelet indices in preterm

PLATELET INDICES	PRESENT STUDY	KANNAR et al	WASILUK et al
1.Mean platelet volume (fL)	8.187±0.918	8.29±0.80	8.02±0.92
2. Platelet distribution width	14.549±3.048	14.79±4.01 fL	50.64±10.32%

The platelet indices, as mentioned before, are direct indicators of platelet activation which induces morphological changes in young platelets, including the formation of spherical and pseudopodia when required. While it is beneficial in most adverse situations in the neonate, unbridled platelet activation may also predispose the preterm and SGA baby to greater risk of thrombosis and DIC both of which are associated with significant morbidity and mortality. Therefore, it is obvious that platelet indices can serve as a surrogate marker for a number of haemostatic disorders and a close serial monitoring of these indices is warranted especially in the sick preterm or small neonate. This study adds to growing literature on the subject that mention that while monitoring these parameters, a mild increase in the MPV and PDW may indeed be expected in the preterm and SGA neonate but greater increases may indeed serve as an early warning of severe disease ahead.

CONCLUSION

The results of this study indicate that healthy preterm and SGA neonates demonstrate increased values of the platelet indices when compared to term new born, even without external challenges. If these neonates are further stressed due to any external cause like asphyxia or infection, they may then be at increased risk for either thrombotic events, bleeding or DIC. Thus it is essential that this fact be kept in mind while serially monitoring the platelet indices in these neonates during which mild increases may be considered as within expected limits but anything greater needs to be investigated thoroughly to identify significant disease early and thus improve neonatal outcome.
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REFERENCES:

1. Maconi M, Rolfo A, Cardaropoli S, Brini M, Danise P. Hematologic values in healthy and small for gestational age newborns. Laboratory hematology: official publication of the International Society for Laboratory Hematology. 2004 Dec;11(2):152-6.
2. Sola-Visner M. Platelets in the neonatal period: developmental differences in platelet production, function, and hemostasis and the potential impact of therapies. ASH Education Program Book. 2012 Dec 8;2012(1):506-11.
3. Strauss T, Sidlik-Muskatel R, Kenet G. Developmental hemostasis: primary hemostasis and evaluation of platelet function in neonates. InSeminars in Fetal and Neonatal Medicine 2011 Dec 31 (Vol. 16, No. 6, pp. 301-304). WB Saunders.
4. Levy-Shraga Y, Maayan-Metzger A, Lubetsky A, Shenkman B, Kuint J, Martinowitz U, Kenet G. Platelet function of newborns as tested by cone and plate (let) analyzer correlates with gestational age. Acta haematologica. 2006 Mar 17;115(3-4):152-6.
5. Kannar V, Deepthi A, Kumar ML, Junjegowda K, Mariyappa N. Effect of gestational age, prematurity and birth asphyxia on platelet indices in neonates. Journal of clinical neonatology. 2014 Jul 1;3(3):144.
6. Jindal S, Gupta S, Gupta R, Kakkar A, Singh HV, Gupta K, Singh S. Platelet indices in diabetes mellitus: indicators of diabetic microvascular complications. Hematology. 2011 Mar 1;16(2):86-9.
7. Kadikoylu G, Yavasoglu I, Bolaman Z, Senturk T. Platelet parameters in women with iron deficiency anemia. Journal of the national medical association. 2006 Mar;98(3):398.
8. Tozkoparan E, Deniz O, Ucar E, Bilgic H, Ekiz K. Changes in platelet count and indices in pulmonary tuberculosis. Clinical Chemical Laboratory Medicine. 2007 Aug 1;45(8):1009- 13.
9. Chu SG, Becker RC, Berger PB, Bhatt DL, Eikelboom JW, Konkle B, Mohler ER, Reilly MP, Berger JS. Mean platelet volume as a predictor of cardiovascular risk: a systematic review and meta-analysis. Journal of Thrombosis and Haemostasis. 2010 Jan 1;8(1):148-56.
10. Hussein NF, Helaly NS, Ghanya EA, Anisb SK. Relationship between Mean Platelet Volume and Bronchopulmonary Dysplasia and Intraventricular Hemorrhage in Very Low Birth Weight Neonates. Journal of American Science. 2012;8(5).
11. Nourripoor S, Tabasizadeh H, Afjehi A, Ghorbani R, Seifhashemi M, Masoudian N. Could mean platelet volume predict developing of bronchopulmonary dysplasia in preterm infants with respiratory distress syndrome?. Iranian Journal of Neonatology IJN. 2013 Oct 1;4(3):35-41.
12. Patrick CH, Lazarchick J, Stubbs T, Pittard WB. Mean platelet volume and platelet distribution width in the neonate. Journal of Pediatric Hematology/Oncology. 1987 Jul 1;9(2):130-2.
13. Wasiluk A, Mantur M, Kemona H, Szczepański M, Jasińska E, Milewski R. Thrombopoiesis in small for gestational age newborns. Platelets. 2009 Jan 1;20(7):520-4.
14. Park Y, Schoene N, Harris W. Mean platelet volume as an indicator of platelet activation: methodological issues. Platelets. 2002 Jan 1;13(5-6):301-6.
15. Patrick CH, Lazarchick J. The effect of bacteremia on automated platelet measurements in neonates. American journal of clinical pathology. 1990 Mar 1;93(3):391-4