

# Platelet Indices in Preterm Neonates: A Prospective Study

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## Abstract

**Introduction:** Platelets in neonates are necessary for hemostasis, phagocytosis, and for maintaining blood vessel integrity. Physiological status of newborn affects hemostatic mechanism. Prematurity, birth asphyxia, and small for gestational age babies are associated with hemostatic abnormalities. The aim of this study was to compare blood platelet indices in preterm neonates and full-term appropriate for gestational age (AGA) neonates and to check whether prematurity affects platelet indices or not.

**Materials and Methods:** Present study was a prospective study conducted in the neonatal intensive care unit of a tertiary care teaching hospital. 30 preterm neonates and an equal number of full-term AGA neonates were included, blood samples were collected within 24 h of birth, and platelet indices were estimated. The data thus obtained was analyzed using the appropriate statistical tool.

**Results:** Sex distribution among both groups was identical. The ratio of male to females in the study was 1.4:1. Mean platelet count in preterm neonates ( $219.72 \times 10^3/\text{mm}^3$ ) was low as compared to term neonates ( $251.26 \times 10^3/\text{mm}^3$ ),  $P = 0.002$ . Plateletcrit (PCT) was also decreased in preterm neonates as compared to term neonates (0.19% vs. 0.21%),  $P = 0.016$ . Mean platelet volume was found to be similar in both preterm and term neonates (8.12 fl and 7.95 fl respectively). Platelet distribution width (PDW) was higher in preterm neonates (15.75) as compared to that of term neonates (12.89).

**Conclusion:** Low values of platelet counts, PCT, and increase in PDW seen in preterm neonates may be due to low gestational age and weight or due to dysfunction of megakaryocytes. Platelet indices may be a vital marker for identification of hemostatic disorders in newborns.

**Key words:** Mean platelet volume, Prematurity, Platelet count, Plateletcrit, Platelet distribution width

## INTRODUCTION

With the improvement in the perinatal and neonatal care, there has been a significant reduction in neonatal mortality and has helped in improvement in survival of preterm neonates.<sup>1</sup> Platelets in neonates are necessary for hemostasis, for maintaining blood vessel integrity and phagocytosis. Hemostasis in a neonate is a dynamic entity which evolves gradually throughout the fetal period and early infancy.<sup>2</sup> Physiological status of newborn affects the hemostasis mechanism. Prematurity, birth asphyxia and

small for gestational age babies (SGA) are associated with hemostatic abnormalities.<sup>3,4</sup>

Hemostasis in newborns is less efficient in comparison to adults.<sup>5</sup> In preterm neonates, blood platelet count is observed to be decreased, depending on the birth weight and gestational age.<sup>6</sup> Platelet has an important role in initiating the thrombotic event, but platelet count alone does not give a complete picture of platelet maturity and its function. Platelet indices such as mean platelet volume (MPV), plateletcrit (PCT), and platelet distribution width (PDW) are utilized for this purpose. Platelet size can be analyzed using MPV and PDW, and it correlates with the activity of platelets. Large platelets are more active and have high thrombotic potential. Hence, these parameters can be used to diagnose thromboembolic disorders at the earliest.

Around 18-35% of neonates admitted to neonatal intensive care unit (NICU) are found to have a platelet

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count of  $\leq 150,000$  cells/ $\mu\text{l}$  at some point of time during stay in NICU.<sup>7-9</sup> It has been observed that the risk of thrombocytopenia in NICU is high among preterm neonates, and it is highest among the most preterm infants.<sup>10</sup> Preterm neonates are prone to develop various complications like intraventricular hemorrhage, chronic lung disease. It has been observed that platelet indices can be used to predict the development of above-mentioned complications at an early stage.<sup>11,12</sup> Only a few studies have been done to determine platelet indices in preterm neonates. The aim of this study was to determine platelet indices in preterm neonates and to compare it with full-term appropriate for gestational age (AGA) healthy neonates. The main focus of this study was to check whether prematurity affects platelet indices or not.

## MATERIALS AND METHODS

The present study was a prospective study conducted in NICU, Department of Pediatrics, Mandya Institute of Medical Sciences, Mandya, Karnataka, India. The study was conducted during July-August 2015. The study consisted of 60 newborns whose blood samples were collected in K<sub>2</sub> ethylenediaminetetraacetic acid tubes within 24 h of birth for complete blood counts. Samples were analyzed using hematology auto analyzer. The following parameters were studied-platelet count, MPV, PCT, PDW. A platelet count of  $\leq 150,000/\mu\text{l}$  was used to define thrombocytopenia. Samples obtained from neonates after 24 h of birth or neonates with birth asphyxia, clinically or laboratory-confirmed infections, major congenital anomalies were excluded from the study.

Neonates were included into the study after obtaining informed written consent from parents. Detailed history regarding antenatal checkup in mother, mode of delivery was obtained. Data regarding the neonatal physiological status with respect to prematurity and gestational age were collected. Both groups of newborns and their mothers were free of infections. There was no pregnancy and perinatal complications. No drugs affecting the functions of platelets were administered to mothers within 10 days before delivery. They were subjected for thorough physical examination. Gestational age was calculated from the date of last menstrual period, in concordance with New Ballard Score.<sup>13</sup> Newborns in gestational age 25-34 weeks and weighing 1000-2150 g with Apgar score of 4-8 at 1 min were considered as preterm neonates. Newborns of gestational age 37-42 weeks and weighing 2500-3900 g with Apgar score of 8-10 at 1 min were considered as full-term AGA neonates.

The data collected were entered in MS Excel spreadsheet. The results are expressed as mean  $\pm$  standard deviation.

Observations were statistically analyzed using Epi Info software version 3.5.1. The Mann-Whitney *U* test was used to analyze the relationship between the two groups. A  $P < 0.05$  was considered as statistically significant. Descriptive statistics was applied for non-parametric data. This study was approved by Institutional Ethics Committee.

## RESULTS

A total of 60 newborns delivered during the study period were included in the present study, of which 30 were full-term AGA neonates and rest 30 were preterm neonates. Out of 60 newborns 58.33% (35) male and 41.67% (25) were females, ratio is 1.4:1. The sex distribution among the study groups was identical (Table 1).

The characteristics of newborns included in the study are shown in Table 2. Mean gestational age in full-term AGA group was 38.87 weeks and in preterm group was 31.71 weeks. Mean birth weight in full-term AGA group was 2937.33 g and in preterm group was 1572.47 g. Mean length in full-term AGA group was 48.89 cm and in preterm group was 40.24 cm. Mean head circumference in full-term AGA group was 34.56 cm and in preterm group was 28.73 cm.

Blood investigation values of study subject are depicted in Table 3. Mean hemoglobin in term neonates was  $16.58 \pm 2.09$  (g/dl) as compared to  $18.19 \pm 1.83$  (g/dl) of preterm neonates, and the difference was statistically significant ( $P = 0.002$ ). Platelet counts in preterm neonates were lower in comparison to term neonates ( $219.72 \times 10^3/\text{mm}^3$  vs  $251.26 \times 10^3/\text{mm}^3$ ), and the difference was statistically significant ( $P = 0.016$ ). PCT

**Table 1: Sex distribution of study subjects**

Sex	Full-term AGA newborns (%)	Preterm newborns (%)	Total (%)
Male	17 (56.67)	18 (60)	35 (58.33)
Female	13 (43.33)	12 (40)	25 (41.67)
Total	30 (50)	30 (50)	60 (100)

AGA: Appropriate for gestational age

**Table 2: Gestational age and anthropometric characteristics of study infants**

Parameter	Mean (range) (n=30)	
	Full-term AGA newborns	Preterm newborns
Gestational age (weeks)	38.87 (37.14-41.29)	31.71 (28.14-33.86)
Birth weight (g)	2937.33 (2650-3870)	1572.47 (1060-2120)
Length (cm)	48.89 (45.7-53.2)	40.24 (34-46.1)
Head circumference (cm)	34.56 (33.1-35.9)	28.73 (24.3-32)

AGA: Appropriate for gestational age

**Table 3: Hemoglobin and blood platelet indices in study infants**

Parameter	Mean±SD		P value
	Full-term AGA newborns	Preterm newborns	
Hemoglobin (g/dl)	16.58±2.09	18.19±1.83	0.002
Platelet count ( $\times 10^3/\text{mm}^3$ )	251.26±63.34	219.72±65.91	0.016
PCT (%)	0.21±0.04	0.19±0.05	0.026
MPV (fl)	7.95±0.60	8.12±0.64	0.247
PDW	12.89±4.65	15.75±6.41	0.029

AGA: Appropriate for gestational age, PCT: Plateletcrit, MPV: Mean platelet volume, PDW: Platelet distribution width, SD: Standard deviation

was also low in preterm neonates as compared to term neonates (0.19% vs. 0.21%), the difference in observation was statistically significant ( $P = 0.026$ ). MPV was similar in both preterm and term neonates (8.12 fl vs. 7.95 fl) ( $P = 0.247$ ). PDW or platelet anisocytosis index was more in preterm neonates (15.75) as compared to term neonates (12.89), and the variation was statistically significant ( $P = 0.029$ ).

## DISCUSSION

Hemostasis in a neonate is a dynamic entity which evolves gradually throughout the fetal and early infancy. Platelets first appear in human fetus at the gestational age of 5 weeks postconception, it gradually increases during the fetal life to reach the adult value by gestational age of 22 weeks.<sup>2</sup> Prematurity, birth asphyxia, and SGA babies are associated with hemostatic abnormalities.<sup>3-6</sup> Hence preterm neonates are at higher risk of hemorrhagic and thrombotic complications, which leads to increase the morbidity and mortality in the preterm neonates.

In our study, it was observed that mean hemoglobin levels in preterm neonates were more as compared to that of term neonates. Polycythemia is a commonly expected problem in preterm neonates.<sup>14</sup> This study showed that average number of platelets in preterm was significantly lower than the platelet count of term neonates. In our study, PCT was lower in preterm neonates in comparison to term neonates, and the difference was statistically significant. In studies by Wasiluk *et al.*, Kannar *et al.* have also reported that platelet counts and PCT in preterm neonate are low in comparison to term neonates.<sup>15,16</sup>

MPV is the measurement of the average size of the platelet in blood and PDW reflects the variation of platelet size. In the present study, MPV was found to be slightly higher in preterm neonates in comparison to term neonates but the difference was not statistically significant. PDW was found to be significantly higher in preterm neonates as compared

to term neonates. Similar findings have been reported in study done by Wasiluk *et al.*<sup>15</sup> However, in study done by Kannar *et al.* have reported that MPV is significantly elevated in preterm neonates.<sup>16</sup>

Lower platelet counts observed in preterm neonates is mostly due to developmental limitation in the ability to increase megakaryocyte size and placental dysfunction may also be responsible for the alteration of platelet count in newborns at birth.<sup>17,18</sup> The reduced platelet count and their function in relation to gestational age may result in higher risk of bleeding tendency in preterm neonates.<sup>4</sup> Elevated PDW without much alteration in MPV may indicate that PDW is a more sensitive index for estimation of changes in platelet size.<sup>19,20</sup> Increase in PDW may be due to negative correlation with gestational age and birth weight.<sup>19</sup> PDW may be useful in detection of conditions like sepsis, platelet consumption at an early stage.<sup>21</sup> The increase in MPV is seen in conditions like disseminated intravascular coagulation which is associated with platelet activation and consumption. Platelet indices determined by automated hematological analyzers may be very useful tool in the diagnosis of hemostatic disorders and infections, which are more often found in preterm newborns.

## CONCLUSION

Low values of platelet counts, PCT, and increase in PDW seen in preterm neonates may be due to low gestational age and weight or due to dysfunction of megakaryocytes. Platelet indices may be a vital marker for identification of hemostatic disorders in newborns.

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