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Research Article

ROP Risk Stratification in Preterm Babies: The Role of Early Postnatal Platelet Count

G Bhavishya[1], Susmitha Joshy[1], Chaitra M C[1]*, James Daniel[2] and Supreetha MS[3]

[1]*Department of Ophthalmology, Sri Devaraj Urs Medical College, Tamaka, Kolar, Karnataka, India*

[2]*Department of Paediatrics, Sri Devaraj Urs Medical College, Tamaka, Kolar, Karnataka, India*

[3]*Associate Professor, Department of Pathology, Sri Devaraj Urs Medical College, Karnataka, India*

***Corresponding Author:** Chaitra M C, Associate Professor, Department of Ophthalmology, Sri Devaraj Urs Medical College, Tamaka, Kolar, Karnataka, India.

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Abstract

Introduction: Retinopathy of prematurity (ROP) is a significant cause of preventable childhood blindness, primarily affecting preterm infants. Its pathogenesis involves two phases: vaso-obliteration followed by vasoproliferation. Various clinical factors, such as gestational age, oxygen therapy, and platelet count, have been investigated to understand their role in the development and progression of ROP. Early detection and risk stratification are crucial for timely intervention and minimizing the need for invasive treatments.

Methodology: This prospective, cross-sectional study included 92 preterm infants with a gestational age of less than 37 weeks. The infants were monitored for ROP, and platelet counts were measured at 72 hours, 2 weeks, 4 weeks, and 6 weeks. Data were analyzed using SPSS version 22, with statistical significance set at a p-value of < 0.05.

Results: The study found significantly higher platelet counts in infants with ROP at all time points (72 hours to 6 weeks) compared to those without ROP, with p-values consistently < 0.001. Additionally, male infants had a higher prevalence of ROP, and no significant difference in mean gestational age was observed between the groups. Our findings suggest that lower platelet counts at 72 hours may be associated with more severe ROP.

Keywords: *Oxygen Exposure; Retinopathy of Prematurity; Thrombocytopenia; Vascular Endothelial Growth Factors*

Introduction

Retinopathy of prematurity (ROP) is a leading preventable cause of childhood blindness, with the potential to result in bilateral retinal detachment if not diagnosed and treated promptly. This sight-threatening condition is considered multifactorial, with prematurity being the primary risk factor, particularly when associated with low gestational age. The risk is further exacerbated by factors such as prolonged elevated oxygen saturation, bronchopulmonary dysplasia, sepsis, ventricular hemorrhage, and genetic predispositions [1]. The pathogenesis of ROP is believed to occur in two distinct phases. The first phase involves vaso-obliteration, triggered by postnatal hyperoxia, which leads to a decrease in angiogenic factors, resulting in retinal hypoxia. In response to this hypoxia, there is an increase in the production of vascular endothelial growth factor (VEGF), driving vasoproliferation, which constitutes the second phase of ROP [2,3]. The National Neonatology Forum (NNF) guidelines recommend that the initial screening should be conducted no later than 4 weeks of age or 30 days of life for infants born at ≥ 28 weeks gestational age. Infants should be screened by the third week of life to facilitate the diagnosis of AP-ROP. For infants born at < 28 weeks or weighing < 1200 grams at birth, screening should be performed earlier, between

2-3 weeks of age, to allow for the early detection of aggressive Retinopathy of Prematurity (AP-ROP) [4]. Additionally, various blood test parameters in premature infants have been studied to explore potential correlations with the development and progression of ROP. This will help the ophthalmologists and neonatologists to detect at risk babies at the earliest and plan efficacious prevention and therapeutic strategies aiming to reduce the need of more invasive treatments for ROP.

Methodology

This prospective, cross-sectional study was conducted over a period of one year with a sample size of 92 preterm infants, all of whom were admitted to a tertiary research center and had a gestational age of less than 37 weeks. The inclusion criteria focused on preterm babies who were admitted to the Neonatal Intensive Care Unit (NICU), while infants lost to follow-up, those with significant congenital abnormalities, ocular defects, or those who died before their Retinopathy of Prematurity (ROP) status could be assessed, were excluded.

Data collection involved gathering detailed histories, including information on blood transfusions, duration of oxygen support, sepsis, and relevant investigations for those diagnosed with ROP. Ocular examinations were performed using a pediatric lid speculum and RETCAM system. The anterior segment was carefully assessed, and pupil dilation was achieved using 0.4% tropicamide and 2.5% phenylephrine. The posterior segment was then examined with RETCAM, ensuring the infants' comfort and safety through gentle pressure. A 2 mL blood sample was drawn for Complete Blood Count analysis, with thrombocyte counts recorded at 72 hours, 2 weeks, 4 weeks, and 6 weeks after birth. The study adhered to the International Classification of Retinopathy of Prematurity (ICROP 3) recommendations for classification.

Data from the study was entered into a Microsoft Excel spreadsheet and analyzed using SPSS version 22 software. Categorical data were represented as frequencies and proportions, and the Chi-square test or Fischer's exact test (for 2x2 tables only) was applied as the test of significance for qualitative data. Continuous data were represented as mean and standard deviation, with the independent t-test used to assess the mean difference between two quantitative variables. For graphical representation, various types of graphs were created using Microsoft Excel and Word. A p-value of less than 0.05 was considered statistically significant, assuming the appropriate statistical test assumptions were met. Data analysis was carried out using MS Excel and SPSS version 22 (IBM SPSS Statistics, Somers, NY, USA).

Results

	Mean	Std. Deviation	P Value
Group 1	31.28	1.747	0.056
Group 2	30.63	1.466	

Table 1: *Comparison of mean gestational age among group.*

The mean gestational age was 31.28 weeks for group 1 and 30.63 weeks for group 2, with a standard deviation of 1.747 and 1.466, respectively. The p-value for the comparison was 0.056, which is greater than the conventional threshold of 0.05, indicating that there was no statistically significant difference between the two groups in terms of mean gestational age. This suggests that gestational age was similar in both groups, and any observed differences were likely due to chance.

The graph visually supports the data presented in table 1, showing the comparison of mean gestational age between subjects with PAD and those without PAD. Table 2 showing distribution of subjects according to sex among groups.

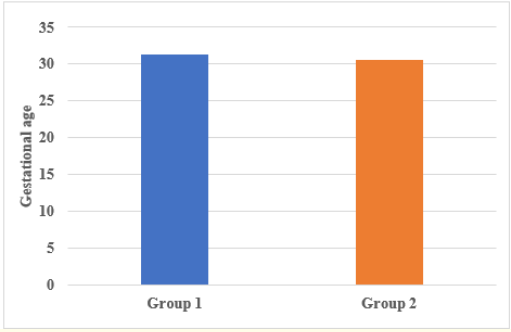

Figure 1: *Graph showing comparison of mean gestational age among subjects with PAD and without PAD.*

The distribution of subjects by sex was quite similar between the two groups. In group 1, 43.5% were female and 56.5% were male, while in group 2, 45.7% were female and 54.3% were male. The p-value was 1.00, indicating no statistically significant difference between the two groups regarding the sex distribution. This suggests that sex was evenly distributed between the groups, and it is unlikely that sex played a role in the differences observed in the study.

	Group 1		Group 2	
	N	%	N	%
Female	20	43.5%	21	45.7%
Male	26	56.5%	25	54.3%

Table 2: *Distribution of subjects according to sex among the group.*

P value 1.00, there was no statistically significant difference found between groups with respect to sex.

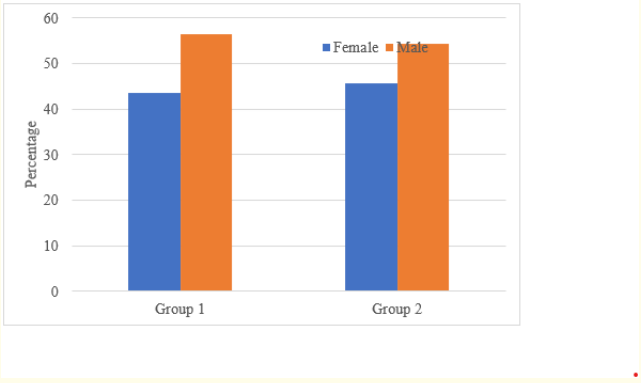

Figure 2: *Graph showing distribution of subjects according to sex among the group.*

The graph in figure 2 provides a visual comparison of the distribution of male and female subjects between the two groups.

	Mean	Std. Deviation	P value
Group 1	346.61	74.747	<0.001
Group 2	186.91	25.528	

Table 3: *Comparison of mean platelet counts among group at 72hrs.*

At 72 hours, the mean platelet count for group 1 was 346.61, with a standard deviation of 74.747, while group 2 had a mean platelet count of 186.91, with a standard deviation of 25.528. The p-value was < 0.001, indicating a statistically significant difference between the two groups. Group 1 exhibited significantly higher platelet counts compared to group 2 at 72 hours. This finding suggests that subjects in group 1 had a markedly different platelet response at this time point, which could be indicative of the underlying condition or intervention studied.

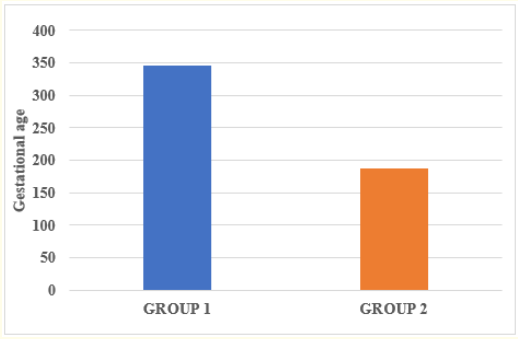

Figure 3: *Graph showing comparison of mean platelet counts among group at 72hrs.*

The graph visually represents the comparison of mean platelet counts at 72 hours, showing a clear difference between the two groups.

	Mean	Std. Deviation	P value
Group 1	346.89	68.072	<0.001
Group 2	185.26	24.079	

Table 4: *Comparison of mean platelet counts among group at 1 week.*

At 1 week, the mean platelet count for group 1 was 346.89 (SD = 68.072), while group 2 had a mean of 185.26 (SD = 24.079). The p-value was <0.001, indicating a statistically significant difference between the two groups. Similar to the findings at 72 hours, group 1 had significantly higher platelet counts compared to group 2 at this follow-up point.

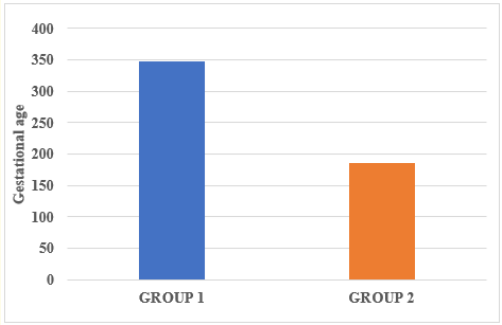

Figure 4: *Graph showing comparison of mean platelet counts among group at 1 week.*

The graph in figure 4 shows the comparison of mean platelet counts at 1 week, supporting the statistical significance observed in table 4.

	Mean	Std. Deviation	P value
Group 1	347.11	59.323	<0.001
Group 2	185.11	23.202	

Table 5: *Comparison of mean platelet counts among group at 2 weeks.*

At 2 weeks, group 1 had a mean platelet count of 347.11 (SD = 59.323), while group 2 had a mean of 185.11 (SD = 23.202). The p-value was < 0.001, again indicating a statistically significant difference between the two groups. The trend of significantly higher platelet counts in group 1 continued through this time point, reinforcing the earlier findings.

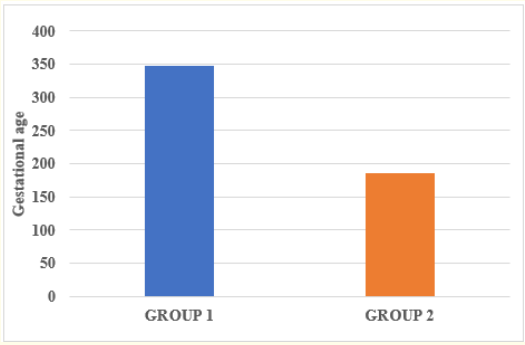

Figure 5: *Graph showing comparison of mean platelet counts among group at 2 weeks.*

The graph in figure 5 illustrates the comparison of platelet counts at 2 weeks, highlighting the significant disparity between the groups.

	Mean	Std. Deviation	P value
Group 1	344.43	57.543	<0.001
Group 2	190.85	20.579	

Table 6: *Comparison of mean platelet counts among group at 4 weeks.*

At 4 weeks, the mean platelet count for group 1 was 344.43 (SD = 57.543), and group 2 had a mean of 190.85 (SD = 20.579). The p-value was < 0.001, indicating that the difference between the groups was statistically significant. This further supports the finding that group 1 consistently exhibited higher platelet counts across various time points.

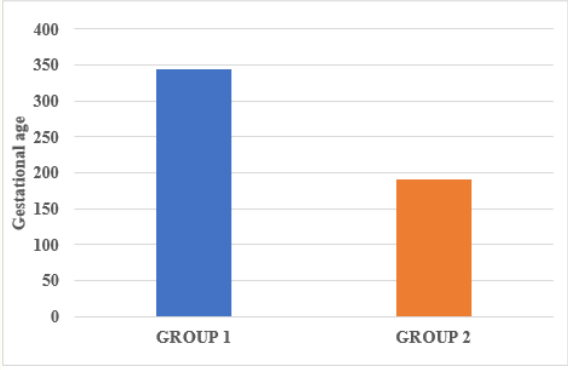

Figure 6: *Graph showing comparison of mean platelet counts among group at 4 weeks.*

The graph in figure 6 shows the continued trend of higher platelet counts in group 1 at 4 weeks.

	Mean	Std. Deviation	P value
Group 1	350.54	51.569	<0.001
Group 2	192.26	23.986	

Table 7: *Comparison of mean platelet counts among group at 6 weeks.*

At 6 weeks, group 1 had a mean platelet count of 350.54 (SD = 51.569), while group 2 had a mean of 192.26 (SD = 23.986). The p-value was < 0.001, indicating a statistically significant difference. The platelet counts for group 1 remained consistently higher compared to group 2, highlighting the sustained differences between the groups.

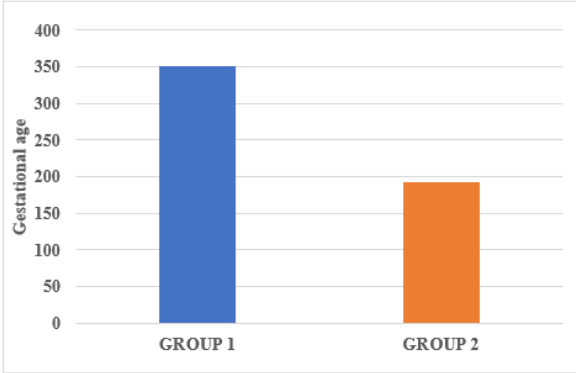

Figure 7: *Graph showing comparison of mean platelet counts among group at 6 weeks.*

The graph in figure 7 shows the platelet counts at 6 weeks, further supporting the statistical significance between the groups.

	Mean	Std. Deviation	P value
Group 1	356.50	60.230	<0.001
Group 2	198.20	19.671	

Table 8: *Comparison of mean platelet counts among group at follow up.*

At the follow-up point, the mean platelet count for group 1 was 356.50 (SD = 60.230), and for group 2, it was 198.20 (SD = 19.671). The p-value was <0.001, indicating a statistically significant difference between the groups. Group 1 continued to show higher platelet counts, maintaining the trend observed at previous time points.

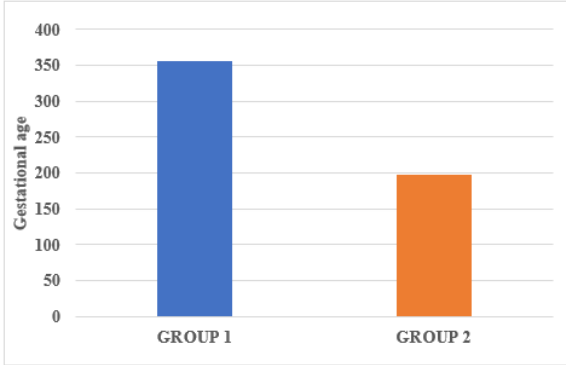

Figure 8: *Graph showing comparison of mean platelet counts among group at follow up.*

The graph in figure 8 illustrates the final comparison of platelet counts at follow-up, demonstrating the persistent differences between group 1 and group 2.

	Group 1		Group 2	
	Mean	SD	Mean	SD
72hrs	347	75	187	26
1 week	347	68	185	24
2 weeks	347	59	185	23
4 weeks	344	58	191	21
6 weeks	351	52	192	24
Follow up	357	60	198	20

Table 9

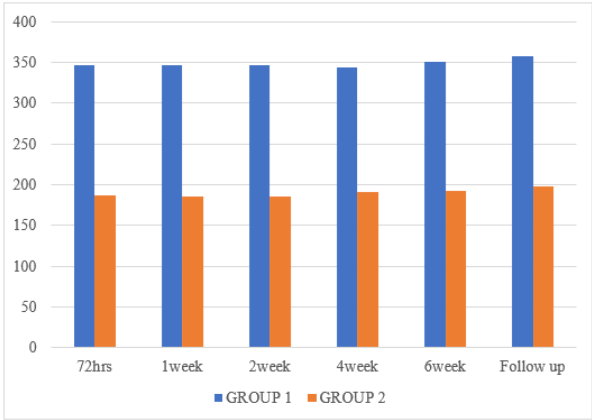

Figure 9

Discussion

In this study, we observed significant differences in the weekly mean platelet count between infants with and without Retinopathy of Prematurity (ROP), consistent with the findings of Lim ZD., *et al*. who noted that platelet count could be a relevant factor in the development of ROP in preterm infants. Platelets, which are essential for blood clotting and immune responses, might contribute to the pathophysiology of ROP by influencing vascular development and inflammation, two key components in the condition's progression. Lim., *et al*. [5] highlighted the potential role of platelet count in predicting ROP severity, which aligns with our observation that variations in platelet count could help identify infants at higher risk for the disease.

Additionally, our study identified a higher prevalence of ROP in male infants, which is consistent with the findings of Akdogan., *et al*. who reported that male preterm infants are more likely to develop ROP compared to their female counterparts. This gender disparity could be linked to differences in the physiological response to premature birth, including factors such as hormonal influences on vascular development and immune function. Akdogan., *et al*. [6] discussed potential biological mechanisms behind this increased susceptibility in males, although the exact pathophysiology remains unclear. Our findings corroborate their hypothesis and underline the importance of considering gender in ROP screening protocols.

Furthermore, in our study, the relationship between gestational age and ROP outcomes was analyzed. Our findings were consistent with those of Gonzalez., *et al*. [7] who concluded that while gestational age is an important factor, it may not be the most critical predictor of ROP outcomes. Gonzalez., *et al*. emphasized that factors like oxygen therapy, nutritional status, and other environmental exposures often have a more significant impact on the development of ROP than gestational age alone. This suggests that while gestational age remains a useful metric for initial ROP risk assessment, clinicians should consider additional variables when determining an infant's risk for ROP progression.

Finally, our study found that preterm infants with lower platelet counts at 72 hours had a higher prevalence of severe ROP, suggesting that platelet monitoring could serve as a useful tool in risk stratification. This finding echoes the conclusions of Kumar., *et al*. who proposed that early platelet count could be a reliable biomarker for predicting severe ROP. Kumar., *et al*. [8] highlighted that platelet count may be involved in inflammatory processes that are implicated in the pathogenesis of ROP, particularly in the context of abnormal retinal vasculature. By incorporating platelet count into routine clinical practice, healthcare providers may be able to identify high-risk infants earlier, enabling more targeted interventions and potentially reducing the incidence of severe ROP.

In summary, our study builds on previous research by Lim., *et al*., Akdogan., *et al*., Gonzalez., *et al*. and Kumar., *et al*. further elucidating the complex interplay of platelet count, gender, gestational age, and other clinical factors in the development of ROP. The findings underscore the need for comprehensive monitoring and personalized risk stratification to improve outcomes for preterm infants with ROP. Further research is needed to explore the precise mechanisms through which platelet count influences ROP progression and to evaluate the feasibility of integrating platelet monitoring into routine clinical practice.

Conclusion

Our study conclude that platelet count in early post natal period will predict ROP risk and progression, high lighting its potential as a valuable predictive marker.

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