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UTILIZING PLATELET MASS INDEX TO FORECAST ROP PROGNOSIS IN PREMATURE INFANTS

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ABSTRACT

Introduction: Retinopathy of prematurity (ROP) is a Vaso proliferative retinopathy affecting the developing retinal vessels in premature infants and is a leading cause of childhood blindness in middle-income countries like India, China, and Latin America. It occurs in 85-90% of low-birth-weight infants exposed to high oxygen concentrations, with an incidence of 39-51.9% in India. Risk factors include prematurity, prenatal complications, multiple gestations, genetic predisposition, sepsis, anemia and oxidative stress. An imbalance of proangiogenic and antiangiogenic cytokines is believed to drive retinal neovascularization in ROP. Platelets, as a cytokine source, may play a role and quantifying platelet levels in early life could indicate ROP progression. This study hypothesizes that increased platelet mass index (PMI) could signal retinal neovascularization in the second phase of ROP. **Material and Methods:** This study was conducted as a cross-sectional analysis at the Tertiary care hospital, Theni between December 2019 and December 2021 with sample size of 100. The population consists of preterm infants with a birth weight less than 1500g and birth age less than 32 weeks are considered to be at risk of ROP during the period of 1 year. **Results:** In this study, 69% of neonates were <32 weeks gestation, with a mean age of 31.88 ± 2.23 weeks. Males comprised 55%, and ROP incidence was 45%. No significant association was found between ROP and age, sex, birth order, delivery mode or gestational age (P>0.05), but birth weight (P<0.05) and oxygen therapy (P<0.0001) were significant risk factors. RDS, sepsis, gestational diabetes and multiple gestations were also linked to ROP (P<0.05). PMI was significantly higher in ROP cases (P<0.0001). The AUC of 0.92 (95% CI: 0.86-0.98, P<0.05) indicated excellent test validity. PMI showed 100% sensitivity, 98% specificity, 97.82% PPV and 100% NPV for ROP diagnosis. **Conclusion:** PMI evaluations, reflecting VEGF levels in ROP's neovascularization phase, can aid in monitoring ROP, reducing reliance on current retinal assessments with their drawbacks. Using PMI in the second ROP phase offers a simple, minimally invasive tool for guiding neonatologists and ophthalmologists in monitoring at-risk preterm infants.

INTRODUCTION

Retinopathy of prematurity (ROP) is a Vaso proliferative retinopathy that affects the developing retinal vessels of premature infants. ROP is emerging as a significant cause of childhood blindness in middle income economies, such as Latin America, Eastern Europe, India, and China [1,2]. ROP can be seen in 85% to 90% of low-birth weight children after being exposed to a high concentration of oxygen [3]. The incidence of ROP in India ranges from 39% and 51.9% in low birthweight infants [4]. Its incidence increases with decreasing gestation and decreasing birth weight [5,6].

Risk factors for ROP was Premature birth, prenatal complications, multiple gestations, genetic factors, immature pulmonary function, sepsis, anemia, intraventricular hemorrhage, patent ductus arteriosus, growth factors, prostaglandin synthetase inhibitors, vitamin E deficiency, lactic acidosis vasoactive substances development of the retinal vessels, maturation of retinal cells with subsequent growth of metabolic demands and the state of the antioxidant [7,8].

An imbalance of proangiogenic and antiangiogenic cytokines is assumed to cause retinal neovascularization and its sequelae in ROP. Platelets, being a source of this cytokines [9,10,11], may have a role in ROP development. Quantification of platelet levels during the first six weeks of life may serve as an early indicator of ROP. The present study hypothesizes that increased platelet mass index (PMI) can indicate retinal neovascularization during the second phase of ROP. The objective of this study to evaluate the Platelet Mass Index as a reliable marker in predicting the prognosis of retinopathy of prematurity in Preterm infants.

MATERIALS AND METHODS

This study was conducted as a cross-sectional analysis at the Tertiary care Hospital, Theni between December 2019 and December 2021 with sample size of 100. The study was approved by the Institutional Ethical Committee (IEC) Registration No. ECR/836/Inst/PB/2016/RR-20) from Government Theni Medical College and Hospital, Theni, Tamilnadu. The population consists of preterm infants with a birth weight less than 1500g and birth age less than 32 weeks are considered to be at risk of ROP during the period of 1 year with inclusion criteria of Preterm newborns with the gestational age less than 32 weeks and gestational weight below 1500g and exclusion criteria of Patients without platelet count data during the first and second phases of ROP, those with sepsis (including fungal sepsis), necrotizing enterocolitis, clinical chorioamnionitis, asphyxia, infants of preeclamptic mothers and those who were given exchange

transfusion, newborns with maternal or paternal platelet diseases and those who themselves had platelet diseases, newborns with diseases which can affect platelet values.

Questionnaire was collected by face to face interview only after explaining purpose and method of data collection of the study using participant information sheet and obtaining informed consent. Data was collected through a structured questionnaire, consisting of Subjects gender, gestational age, birth weight, duration of mechanical ventilation, oxygen support and number of red blood cell transfusions, mechanical ventilation duration, Oxygen use (in days), the platelet values taken from preterm newborns at the 32nd postmenstrual week were considered to be the values reflecting the second phase of ROP, while those taken before the 32nd week (in the first ten days) were considered to reflect the first phase of ROP.

Statistical Analysis

SPSS 21.0 (SPSS Inc. Chicago, Illinois) was used for statistical analyses. The Shapiro Wilk normality test was utilized to determine whether the data had a normal distribution. Data with normal distribution were compared with an independent sample t-test, and the Manne Whitney U test was used for inter-group comparisons of nonnormally distributed data analysis. The chi-square test was used to analyze categorical variables. Statistical significance was considered at $p < 0.05$. The receiver operating characteristic (ROC) analysis was performed using SPSS version 21.0 and easy ROC (a web tool for ROC curve analysis version 1.3). The area under the curve (AUC) of PMI and platelet measurement values was evaluated using the ROC curve (Figure. 1). The Youden cut-off method was used to determine cut-off values.

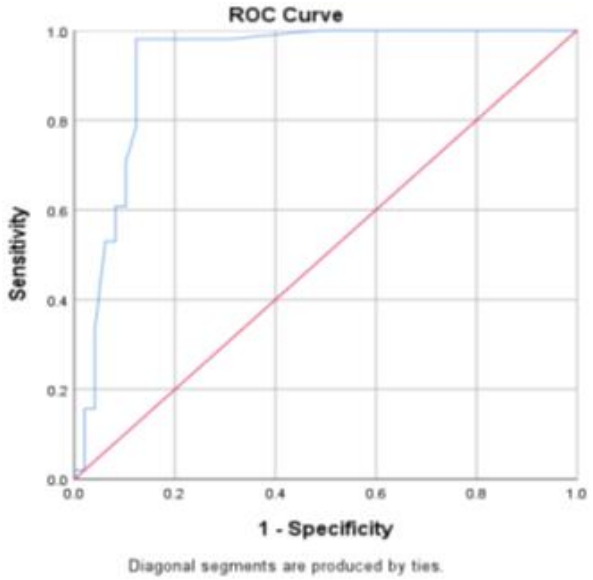

Figure. 1. ROC analysis for the diagnostic ability of platelet mass index.

RESULTS

In the present study 69% of neonates had gestational age of less than 32 weeks and 31% had more than 32 weeks gestational age. Mean gestational age is 31.88 weeks and standard deviation is 2.23. 55% were male neonates and 45% were female neonates. Incidence of retinopathy of prematurity is 45%. There is statistically no significant association between Age, sex, order of birth, mode of delivery, Gestational age and ROP ($p>0.05$). There is statistically significant association between birth weight and Retinopathy of prematurity ($p<0.05$). Neonates who have received oxygen therapy are more at risk of developing Retinopathy of prematurity. There is statistically significant association bet-ween oxygen therapy and Retinopathy of prematurity ($p<0.0$ 001). Among the neonatal risk factors respiratory distress syndrome and sepsis are significantly associated with retinopathy of prematurity ($p<0.0$ 5). Among the maternal risk factors gestational diabetes and multiple gestation are significantly associated with retinopathy of prematurity ($p<0.05$) (Table. 1).

Neonates with retinopathy of prematurity had more platelet index compared to neonates without retinopathy of prematurity. There is statistically significant association between both the groups ($p<0.0001$). Area under curve (AUC) is 0.92 (0.86-0.98) (95% CI) ($p<0.05$) which indicate Excellent test validity in sense of its ability to correctly classify those with and without ROP. Sensitivity, Specificity, PPV, NPV for PMI to diagnose the ROP was 100%, 98%, 97.82%, 100% respectively (Table. 1).

Table. 1. Association between Birth weight and Retinopathy of prematurity, Association between oxygen therapy and Retinopathy of prematurity and Platelet mass index among study participants

Association between Birth weight and Retinopathy of prematurity				
Oxygen Therapy	ROP	No ROP	Chi square	P value
≤1.5 kg	34	56	3.66	0.05
>1.5 kg	11	39		
Total	45	55		
Association between oxygen therapy and Retinopathy of prematurity				
Yes	44	10	63.12	<0.000
No	1	45		
Total	45	55		
Platelet mass index among study participants				
	Mean	SD	t value	P value
ROP	3608	1268	7.83	0.0001
No ROP	3160	1210		

DISCUSSION

Studies in 2010 and 2011 linked thrombocytopenia to severe ROP and laser photocoagulation therapy [1,2]. Platelets contribute to vascularization by stimulating endothelial cells, influencing VEGF levels. Our study suggests PMI is significant in ROP monitoring, with PMI rises in the second phase correlating with VEGF increases, particularly in advanced cases requiring laser treatment. Low gestational age and birth weight are key ROP risk factors, along with PDA and BPD. PMI combining platelet counts and MPV showed a significant increase in the second ROP phase, warranting further research to refine its sensitivity and specificity.

The shortfall of any distinctions in PMI esteems between the reviews bunches during the main period of ROP related with vaso -obliteration was ascribed to the low VEGF levels during this stage. Then again, the reason for the critical distinction in PMI esteems during the subsequent stage of ROP related with vaso-proliferation is by all accounts the low VEGF levels of the CG not needing laser photocoagulation treatment during the second period of ROP versus high VEGF levels in the LPG requiring laser photocoagulation treatment during the second period of ROP. This huge contrast in PMI esteems which, we accept reflects high VEGF levels in the second period of ROP might aid deciding the treatment approach by working with the ideal development of the preterm babies in danger for ROP also may give direction to clinician respects to the ROP prognosis.

CONCLUSION

In our review, we arrived at the resolution that PMI evaluations which, we think, reflect the VEGF levels in the neovascularization period of ROP can offer offices to both patients and doctors in checking ROP by changing the existing retinal assessment technique which has an incredible many disservices as far as secondary effects coming about because of both the utilization of workforce and practice in neonatal serious consideration units. Utilization of PMI levels during the second period of ROP could be a straight forward, valuable negligibly obtrusive strategy that may give starter direction to neonatologists and ophthalmologists on the best way to play out a more fragile follow-up of ROP in preterm babies in danger for ROP.

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