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TO STUDY THE ROLE OF POSTNATAL WEIGHT GAIN IN PREDICTING THE SEVERITY OF RETINOPATHY OF PREMATURITY IN TERTIARY CARE CENTRE

Ophthalomology

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ABSTRACT

Background: Retinopathy of Prematurity (ROP) is a major cause of preventable childhood blindness. Early identification of high-risk neonates is essential for timely intervention. Postnatal weight gain has emerged as a potential predictor for ROP severity. **Aim & Objectives:** To study the role of postnatal weight gain in predicting the severity of ROP in a tertiary eye care centre. **Methods:** This prospective study included 120 preterm neonates with birth weight ≤1500 g and gestational age ≤32 weeks. Serial weight measurements were recorded weekly from 2 to 10 weeks. ROP screening was performed as per standard guidelines and classified according to ICROP. Neonatal and maternal risk factors were analyzed. Statistical analysis was done using SPSS version 26.0.**Results:** The mean birth weight and gestational age were 1109.6 ± 212.52 g and 29.34 ± 1.48 weeks, respectively. Stage 2 ROP was the most common (41.7%). Significant associations were found between ROP severity and birth weight, gestational age, oxygen therapy, respiratory distress syndrome, and blood transfusion ($p < 0.05$). Early postnatal weight gain (weeks 2–5) showed a significant correlation with ROP severity and outcomes, with lower weight gain observed in severe cases. **Conclusion:** Early postnatal weight gain emerged as a simple and effective predictor of disease severity, with poor weight gain during the early postnatal weeks being associated with more severe ROP.

KEYWORDS

Retinopathy of Prematurity, Postnatal Weight Gain, Prematurity, Low Birth Weight, Neonatal Risk Factors

INTRODUCTION

Retinopathy of Prematurity (ROP) is a vasoproliferative disorder of the developing retina that primarily affects preterm and low birth weight infants. It remains one of the leading causes of preventable childhood blindness worldwide, particularly in developing countries like India, where advances in neonatal care have improved survival rates of premature infants. However, increased survival has also led to a rising incidence of ROP, often referred to as the "third epidemic" of ROP. [1]

The pathogenesis of ROP is complex and multifactorial. It involves an initial phase of delayed retinal vascular growth due to hyperoxia, followed by a second phase characterized by hypoxia-induced pathological neovascularization. [2] Several risk factors have been identified, including low gestational age, low birth weight, oxygen therapy, sepsis, anemia, and poor postnatal weight gain. Among these, postnatal growth has emerged as a significant and modifiable predictor of disease severity. [3]

In recent years, increasing attention has been given to postnatal weight gain as an indirect marker of Insulin-like Growth Factor-1 (IGF-1) levels, which play a crucial role in normal retinal vascular development. Poor weight gain reflects low IGF-1 levels, which in turn impairs physiological vascularization and predisposes to abnormal neovascularization seen in ROP. [4] This relationship has led to the development of various predictive models such as WINROP (Weight, Insulin-like Growth Factor, Neonatal ROP), which utilize serial weight measurements to identify infants at risk of developing severe ROP. [5]

Several studies have demonstrated that slow postnatal weight gain is strongly associated with the development of treatment-requiring ROP. Wallace et al.[6] and Hellström et al.[4] reported that infants with inadequate weight gain in the early postnatal period have a significantly higher risk of developing severe ROP. This has important clinical implications, as monitoring weight gain is simple, cost-effective, and feasible even in resource-limited settings.

In India, where the burden of prematurity is high, early identification of infants at risk for severe ROP remains a challenge. Conventional screening guidelines based on birth weight and gestational age may not be sufficient to predict disease progression. Therefore, incorporating postnatal weight gain as a predictive tool may enhance early detection and timely intervention, thereby reducing the risk of visual impairment. [7]

The present study aims to evaluate the role of postnatal weight gain in predicting the severity of ROP in preterm infants attending a tertiary eye care centre in Punjab. By analysing weight gain trends at regular intervals, this study seeks to establish a practical and reliable predictor for identifying infants who may require treatment.

MATERIALS AND METHODS

This prospective study was conducted in the Department of Ophthalmology in collaboration with the Department of Paediatrics at Government Medical College, Amritsar, over a period of one year after obtaining ethical clearance from the Institutional Ethics Committee.

Study Population

The study included neonates admitted to the Neonatal Intensive Care Unit (NICU) who were referred for Retinopathy of Prematurity (ROP) screening. All preterm infants with a gestational age of ≤32 weeks and/or birth weight ≤1500 grams were considered eligible for inclusion.

Inclusion Criteria

Neonates fulfilling the following criteria were included:

- Gestational age ≤32 weeks.
- Birth weight ≤1500 grams.

Exclusion Criteria

Neonates were excluded if:

- Parents or guardians refused consent.
- The infant did not complete the follow-up protocol.
- The infant had received prior treatment for ROP elsewhere.
- The infant died before the first ROP screening (<4 weeks of birth).
- The infant was diagnosed with intrauterine growth restriction (IUGR).

Study Procedure
Baseline demographic and clinical characteristics of all enrolled neonates were recorded in a predesigned proforma. Detailed history including perinatal events, NICU stay, associated complications, and their management were documented.

All infants underwent their first ROP screening at 4 weeks postnatal age. Subsequent follow-up examinations were scheduled based on the findings of the initial screening. Infants without ROP were re-evaluated every two weeks until complete retinal vascularization. Infants diagnosed with Stage 1 and Stage 2 ROP disease were followed up weekly whereas infants with Stage 3 ROP disease were followed up more frequently until regression or complete vascularization occurred.

Ophthalmic Examination
Pupillary dilatation was achieved approximately one hour prior to examination using tropicamide 0.5% and phenylephrine 2.5% eye drops, instilled three times at 10-minute intervals. Care was taken to ensure that the infant had not been fed within one hour prior to examination to reduce the risk of aspiration.

All examinations were performed under topical anesthesia using proparacaine 0.5% eye drops. A sterile pediatric lid speculum was inserted to keep the eyelids apart, and scleral indentation was performed to visualize the peripheral retina. The posterior pole was examined first, followed by detailed examination of the peripheral retina.

ROP findings were documented and classified according to the International Classification of Retinopathy of Prematurity (ICROP). Relevant neonatal and maternal risk factors were also recorded.

Management
Infants diagnosed with aggressive ROP were treated with intravitreal anti-vascular endothelial growth factor (anti-VEGF) injections and/or laser photocoagulation as per standard treatment guidelines.

Outcome Measures
The primary outcome was to assess the role of postnatal weight gain in predicting the severity of Retinopathy of Prematurity (ROP) during the early postnatal period.

The secondary outcome was to identify additional neonatal and maternal risk factors associated with the development and progression of ROP.

RESULTS
The distribution of neonates based on birth weight revealed that the majority of infants belonged to the 1000–1500 g category, accounting for 60% (n = 72) of the study population. This was followed by 35% (n = 42) neonates in the 750–1000 g group, while only a small proportion, 5% (n = 6), had a birth weight of less than 750 g, representing extremely low birth weight (ELBW) infants. The mean birth weight was calculated to be 1109.6 ± 212.52 grams, indicating that most neonates in the study fell within the low birth weight (LBW) range. This distribution highlights that a significant proportion of the study population consisted of moderately preterm infants, who are known to be at considerable risk for developing Retinopathy of Prematurity (ROP).(Table 1)

The gestational age distribution demonstrated that an equal proportion of neonates were born between 28–30 weeks and 30–32 weeks, each contributing 45% (n = 54) of the total study population. A smaller subset, 10% (n = 12), consisted of extremely preterm neonates born at less than 28 weeks of gestation. The mean gestational age was found to be 29.34 ± 1.48 weeks, reflecting that the majority of neonates were moderately preterm. This distribution is clinically relevant, as decreasing gestational age is strongly associated with increased susceptibility to ROP due to incomplete retinal vascular development at birth.(Table 2)

The baseline characteristics of the neonates revealed a slight male predominance, with 56.7% (n = 68) males compared to 43.3% (n = 52) females. In terms of mode of delivery, the majority of neonates were delivered via Lower Segment Caesarean Section (LSCS), accounting for 62.5% (n = 75), while 37.5% (n = 45) were delivered through Normal Vaginal Delivery (NVD). Regarding birth order, a significant majority of the neonates were singletons (81.7%, n = 98), with multiple births comprising the remaining proportion, including twins (13.4%) and triplets (5.1%). These baseline characteristics provide important contextual information, as factors such as multiple gestation and mode of delivery may influence neonatal outcomes and risk of ROP.(Table 3) Among the neonatal risk factors evaluated, Respiratory Distress Syndrome (RDS) was present in 63.3% (n = 76) of neonates, making it one of the most common complications observed. Similarly, oxygen therapy was required in 64.2% (n = 77) of cases, with a mean duration of 13.08 ± 11.13 days, indicating prolonged oxygen exposure in a substantial number of infants. Additionally, 30.8% (n = 37) of neonates received blood transfusions, reflecting the presence of significant hematological or clinical instability. These findings underscore the importance of neonatal comorbidities, particularly oxygen exposure and respiratory complications, as established risk factors contributing to the development and progression of ROP.(Table 4)

The analysis of maternal risk factors demonstrated that maternal diabetes was the most prevalent condition, observed in 26.7% (n = 32) of cases. This was followed by multiple gestations (19.2%, n = 23) and pregnancy-induced hypertension (PIH) (18.3%, n = 22). Other notable factors included antepartum hemorrhage (14.2%, n = 17) and maternal smoking (7.5%, n = 9). It is important to note that multiple risk factors were present in some cases. These maternal conditions may indirectly influence fetal growth, prematurity, and neonatal complications, thereby contributing to an increased risk of ROP development.(Table 5)

The severity distribution of Retinopathy of Prematurity among the study population indicated that Stage 2 ROP was the most commonly observed stage, accounting for 41.7% (n = 50) of cases. This was followed by Stage 0 (immature retina) in 24.2% (n = 29) of neonates, suggesting a considerable proportion with incomplete retinal vascularization but no active disease. More advanced disease was seen in 18.3% (n = 22) of neonates with Stage 3 ROP, while Stage 1 ROP was present in 15.8% (n = 19). The predominance of Stage 2 ROP indicates a moderate severity pattern in the study population, with a significant number of neonates requiring close monitoring and potential intervention to prevent disease progression.(Table 6)

DISCUSSION
Retinopathy of Prematurity (ROP) remains a significant cause of preventable childhood blindness, particularly in developing countries with improving neonatal survival. The present study evaluated the role of postnatal weight gain in predicting ROP severity along with associated risk factors.

In our study, lower birth weight and gestational age showed a strong association with increasing ROP severity, which is consistent with established literature identifying prematurity and low birth weight as primary risk factors.[8,9] The mean birth weight and gestational age in our study population further reflect a predominantly moderate-to-high-risk neonatal group.

Among neonatal risk factors, oxygen therapy and Respiratory Distress Syndrome (RDS) were significantly associated with ROP severity. These findings align with earlier studies demonstrating that prolonged oxygen exposure and fluctuations contribute to abnormal retinal vascularization.[10,11] Blood transfusion was also found to be significantly associated with increased disease severity, supporting previous evidence suggesting its role in oxidative stress and progression of ROP.[12]

With respect to maternal factors, maternal diabetes showed a significant association with ROP severity, whereas other factors such as pregnancy-induced hypertension, smoking, and antepartum hemorrhage did not demonstrate significant relationships. These findings are partly consistent with previous studies indicating that maternal metabolic conditions may influence neonatal outcomes, though evidence for other maternal factors remains inconsistent.[13,14]

The majority of neonates in our study had Stage 2 ROP, indicating a predominance of moderate disease, which is comparable to findings from large screening trials.[15] Zone II was the most commonly involved region, consistent with the International Classification of ROP.[16]

A key finding of this study is that early postnatal weight gain (weeks 2–5) was significantly associated with ROP severity, whereas later

weight gain did not show consistent significance. Neonates with poor early weight gain were more likely to develop severe ROP and require treatment. These findings are in agreement with studies on the WINROP algorithm, which emphasize early weight gain as a reliable predictor of treatment-requiring ROP.[17,18]

Outcome analysis showed that most neonates had spontaneous regression or favorable outcomes, with only a small proportion progressing to advanced stages. This highlights the importance of timely screening and intervention in improving prognosis.[19]

Overall, the study confirms that low birth weight, prematurity, oxygen exposure, blood transfusion, and poor early postnatal weight gain are significant predictors of ROP severity. Among these, early weight gain serves as a simple, non-invasive, and cost-effective tool for early identification of high-risk neonates.

CONCLUSION

Low birth weight and prematurity are the strongest predictors of Retinopathy of Prematurity (ROP). Neonatal factors such as oxygen therapy, respiratory distress, and blood transfusion further increase disease severity. Poor early postnatal weight gain (weeks 2–5) is significantly associated with severe ROP and adverse outcomes, while adequate weight gain correlates with regression and normal vascularization.Thus, early weight gain monitoring serves as a simple and effective predictor for identifying high-risk neonates and thus timely screening can improve management of ROP.

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TABLES

Table 1. Distribution of Neonates According to Birth Weight (N = 120)

Birth Weight (g)	Number of Neonates	Percentage (%)
<750	6	5.0
750–1000	42	35.0
1000–1500	72	60.0
Total	120	100.0

Table 2. Distribution of Neonates According to Gestational Age (N = 120)

Gestational Age (Weeks)	Number of Neonates	Percentage (%)
<28	12	10.0
28–30	54	45.0
30–32	54	45.0
Total	120	100.0

Mean Gestational Age = 29.34 ± 1.48 weeks

Table 3. Baseline Characteristics of Neonates (N = 120)

Characteristic	Category	Number of Neonates (n)	Percentage (%)
Gender	Male	68	56.7
	Female	52	43.3
Mode of Delivery	NVD	45	37.5
	LSCS	75	62.5
Birth Order	Single	98	81.7
	Twin-1	8	6.7
	Twin-2	8	6.7
	Triple-1	2	1.7
	Triple-2	2	1.7
	Triple-3	2	1.7

Table 4. Neonatal Risk Factors for Retinopathy of Prematurity (ROP)

Risk Factor	Number of Neonates	Percentage (%)
Respiratory Distress Syndrome (RDS)	76	63.3
Oxygen Therapy	77	64.2
Blood Transfusion	37	30.8

Mean Duration of Oxygen Therapy = 13.08 ± 11.13 days

Table 5. Maternal Risk Factors for Retinopathy of Prematurity (ROP)

Maternal Risk Factor	Number of Mothers	Percentage (%)
Maternal Diabetes	32	26.7
Maternal Smoking	9	7.5
Pregnancy-Induced Hypertension (PIH)	22	18.3
Antepartum Hemorrhage	17	14.2
Multiple Gestation	23	19.2

Multiple risk factors were present in some mothers.

Table 6. Distribution of Neonates According to Severity of Retinopathy of Prematurity (N = 120)

ROP Stage	Number of Neonates	Percentage (%)
Stage 0 (Immature Retina)	29	24.2
Stage 1	19	15.8
Stage 2	50	41.7
Stage 3	22	18.3
Total	120	100.0

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