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Frequency of Retinopathy of Prematurity in Infants Born Before 34 Weeks of Gestation

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ABSTRACT

Background: Retinopathy of prematurity (ROP) is a proliferative retinal disorder that primarily affects preterm infants with incomplete retinal vascularization. **Objective:** To determine the frequency of ROP in infants born before 34 weeks of gestation and identify associated risk factors. **Methods:** This Cross-sectional study was conducted at the Hameed Latif Hospital, Lahore from 1st Oct 24 to 31st March 2025. Data were collected through non-probability consecutive sampling. The calculated sample size was 124 neonates. For each enrolled participant, demographic and clinical data including gestational age, gender, birth weight, days since admission, and supplemental oxygen therapy status (given/not given and duration in days) were recorded by the researcher on a predesigned proforma. **Results:** Out of 124 infants, 19 (15.3%) were diagnosed with ROP. A significant association was found between ROP and gestational age <30 weeks (p = 0.002), birth weight <1500 grams (p = 0.01), and supplemental oxygen therapy (p = 0.04). Prolonged oxygen therapy (>5 days) further increased ROP risk (p = 0.03). Most ROP cases were early stage (Stage 1: 47.4%, Stage 2: 31.6%, Stage 3: 21.0%). No cases of Stage 4 or 5 were observed. **Conclusion:** It is concluded that ROP is a relatively common complication among preterm infants born before 34 weeks. Lower gestational age, low birth weight, and prolonged oxygen therapy significantly increase the risk. These findings reinforce the need for standardized screening and regulated oxygen administration in neonatal care to reduce preventable visual morbidity.

INTRODUCTION

Retinopathy of prematurity (ROP) is a retinal vaso-proliferative condition that primarily affects preterm infants and is a primary cause of childhood blindness around the world. The number of newborns at risk for ROP has been increasing all over the world as a result of an increase in premature deliveries and an improvement in survival rates due to advancements in neonatal care [1]. ROP is characterized by aberrant neovascularization in two postnatal stages. In the first phase, from birth to 32 weeks postmenstrual, hyperoxia, or "oxygen toxicity" prevents normal vascular formation in the retina. Even room air causes hyperoxia in premature newborns relative to the intrauterine environment, and oxygen supplementation increases it. Hyperoxia stops retinal vessel growth and partially shrinks existing vessels. In the second phase, hypoxia-induced vaso-proliferation follows. Incomplete vascularization leads the retina to become hypoxic, releasing angiogenic agents including VEGF and erythropoietin, leading to neovascularization, intraocular fibrosis, and retinal detachment [2, 3]. For this purpose, hospitals are working to set oxygen saturation targets in these children [4, 5].

It has been recommended that premature children should be screened for retinopathy of prematurity and the diagnosis is based on the recommendations of "International Classification of Retinopathy of Prematurity (ROP)" [6]. The frequency of ROP in premature infants depends upon varies with the demographics as it is dependent upon the availability of advanced healthcare facilities for the management of preterm infants [7]. A study reported that the frequency of retinopathy of prematurity (ROP) in infants born before 34 weeks of gestation was 13.7% [8]. In another study which was conducted with the same aim it was reported that the frequency of retinopathy of prematurity (ROP) in infants born before 34 weeks of gestation was 8.8% [9].

Retinopathy of prematurity (ROP) is vision threatening condition that can lead to permanent blindness. It is essential to screen the premature newborns for presence of this condition as they are more prone to have ROP. Screening is essential to diagnose and provide appropriate

treatment in case of presence of disease to avoid blindness in a premature child who is already prone to various other morbidities owing to prematurity. This study is, therefore, aimed to determine frequency of retinopathy of prematurity (ROP) in infants born before 34 weeks of gestation so that with timely diagnosis and prompt treatment ocular morbidity can be reduced in premature newborns.

Objective

To determine frequency of retinopathy of prematurity (ROP) in infants born before 34 weeks of gestation.

METHODOLOGY

This Cross-sectional study was conducted at Hameed Latif Hospital, Lahore from 1st Oct 24 to 31st March 2025. Data were collected through non-probability consecutive sampling. The sample size was calculated using the WHO sample size calculator, with the following parameters: confidence level of 95%, absolute precision of 5%, and an expected frequency of retinopathy of prematurity (ROP) in infants born before 34 weeks gestation of 8.8% [9]. The calculated sample size was 124 neonates.

Inclusion Criteria

- Newborns who will be born at gestational age less than 34 weeks (labelled by consultant obstetrician after dating scan performed pre-delivery) admitted in NICU.
- Either male or female.
- Have body weight less than 2000 grams, measured by researcher using standard weighing scale.

Exclusion Criteria

Following will be excluded from the study:

- Newborns born at or after 34 weeks gestation.
- Congenital anomalies found on anomaly scan.
- Chromosomal abnormalities related syndromes, assessed clinically by consultant pediatrician.

Data collection

After receiving approval from the institutional ethical review board and the College of Physicians and Surgeons Pakistan (CPSP), and obtaining written informed consent from the parents or guardians, all eligible neonates were enrolled in the study. Patients who met any exclusion criteria were excluded. For each enrolled participant, demographic and clinical data including gestational age, gender, birth weight, days since admission, and supplemental oxygen therapy status (given/not given and duration in days) were recorded by the researcher on a predesigned proforma. Each infant underwent a detailed fundoscopic examination by a consultant ophthalmologist using indirect ophthalmoscopy with a +20D lens after pharmacological pupil dilation with 0.5% tropicamide and 2.5% phenylephrine. Diagnosis and staging of ROP were based on standard criteria as per the operational definition. Infants diagnosed with ROP received appropriate management based on the stage and severity of disease. All patient data were handled confidentially to maintain anonymity.

Data analysis

Data analysis was performed using IBM SPSS version 20. The normality of continuous variables was assessed using the Shapiro-Wilk test. Normally distributed variables, including gestational age, birth weight, duration since admission, and duration of oxygen therapy, were expressed as mean ± standard deviation (SD), while non-normally distributed variables were expressed as median with interquartile range (IQR). Categorical variables such as gender, oxygen therapy status, presence of ROP, and ROP stage were presented as frequencies and percentages. To assess effect modifiers, data were stratified based on gestational age, gender, birth weight, duration of hospitalization, and oxygen supplementation. Post-stratification analysis was conducted using the chi-square test. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

Data were collected from 124 patients. The mean gestational age of the neonates included in the study was 31.2 ± 1.8 weeks, and the mean birth weight was 1480 ± 260 grams. Of the 124 infants, 72 (58.1%) were male and 52 (41.9%) were female. Supplemental oxygen was administered to 91 infants (73.4%), while 33 (26.6%) did not receive oxygen. The mean duration of oxygen therapy was 6.4 ± 3.1 days, and the average duration since NICU admission at the time of examination was 4.9 ± 2.7 days.

Table 1

Demographic and Baseline Characteristics of Study Participants (n = 124)

Variable		Value
Mean Gestational Age (weeks)		31.2 ± 1.8
Mean Birth Weight (grams)		1480 ± 260
Gender	Male	72 (58.1%)
	Female	52 (41.9%)
Supplemental Oxygen Given		91 (73.4%)
Not Given		33 (26.6%)
Mean Duration of Oxygen (days)		6.4 ± 3.1
Mean Duration Since Admission (days)		4.9 ± 2.7

A higher frequency of ROP was observed in neonates with gestational age <30 weeks (31.6%) compared to those born at 30–32 weeks (9.6%) and >32 weeks (5.9%), with the association being statistically significant (p = 0.002). Similarly, infants with birth weight <1500 grams had a significantly higher rate of ROP (22.0%) compared to those ≥1500 grams (9.2%) (p = 0.01). No significant difference in ROP frequency was found between male (15.3%) and female (15.4%) neonates (p = 0.98).

Table 2

Frequency of ROP by Gestational Age

Gestational Age	n (%)	ROP Present n (%)	p-value
<30 weeks	38 (30.6%)	12 (31.6%)	0.002
30–32 weeks	52 (41.9%)	5 (9.6%)	
>32–<34 weeks	34 (27.4%)	2 (5.9%)	
Birth Weight			
<1500 grams	59 (47.6%)	13 (22.0%)	0.01
≥1500 grams	65 (52.4%)	6 (9.2%)	
Gender			
Male	72 (58.1%)	11 (15.3%)	0.98
Female	52 (41.9%)	8 (15.4%)	

ROP was significantly more frequent in neonates who received supplemental oxygen (18.7%) compared to those who did not (5.9%) (p = 0.04). The duration of oxygen therapy also showed a significant association, with infants receiving oxygen for more than 5 days developing ROP at a higher rate (27.9%) than those treated for 5 days or less (10.4%) (p = 0.03). Among infants who did not receive oxygen, the ROP rate remained low (6.1%).

Table 3

Frequency of ROP by Supplemental Oxygen Use

Supplemental Oxygen	n (%)	ROP Present n (%)	p-value
Given	91 (73.4%)	17 (18.7%)	0.04
Not given	33 (26.6%)	2 (5.9%)	
Duration of Oxygen			
≤5 days	48 (38.7%)	5 (10.4%)	0.03
>5 days	43 (34.7%)	12 (27.9%)	
Not applicable	33 (26.6%)	2 (6.1%)	

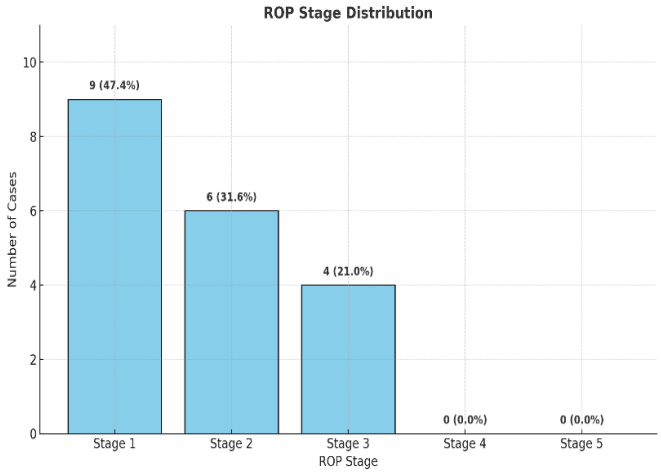
Among the 19 neonates diagnosed with retinopathy of prematurity, the majority had early-stage disease. Stage 1 ROP was observed in 9 cases (47.4%), followed by Stage 2 in 6 cases (31.6%), and Stage 3 in 4 cases (21.0%). No cases of advanced ROP (Stage 4 or 5) were identified in the study population.

Table 4

Distribution of ROP by Clinical Stage

ROP Stage	Number of Cases	Percentage (%)
Stage 1	9	47.4
Stage 2	6	31.6
Stage 3	4	21.0
Stage 4	0	0.0
Stage 5	0	0.0

Figure 1



DISCUSSION

This cross-sectional study aimed to determine the frequency of retinopathy of prematurity (ROP) in neonates born before 34 weeks of gestation. In 124 preterm infants, the prevalence of ROP was determined to be 15.3 % which is above the national rate (8.8 %) previously reported. These increases may be attributed to the changing neonatal practices, NICU standards fluctuation, or the improvement in the survival rate for the lower gestational age infants in the previous years. Notably, this frequency emphasizes the continued significance of ROP as a public health issue in neonatal treatment in developing countries such as Pakistan[10]. Our results showed a statistically significant relationship between low gestational age and increased risk of the severity of the disease ROP (p = 0.002), where the highest incidence, 31.6%, was found in infants born under 30 weeks. This concurs with international literature that describes extreme prematurity as a key risk factor for abnormal retinal vascular development through incomplete vascularization at birth[11]. Birth weight was also a significant risk factor (p = 0.01), with neonates weighing below 1500 grams having a higher incidence of ROP (22.0%) compared to neonates weighing beyond this limit (9.2%). This corresponds with findings from studies by Fierson et al., (2018)[12] who highlighted low birth weight as an independent predictor for the severity of ROP. Oxygen therapy was another remarkable factor. children who were given supplementary oxygen had a significantly increased ROP rate (18.7%) in comparison with those who did not (5.9%) (p < 0.04). Moreover, chronic oxygen therapy for > 5 days was also significantly associated with the increased risk (27.9%, p = 0.03). While oxygen continues to be a pillar in the management of respiratory distress in preterm infants, unregulated or prolonged administration is an established cause of retinal neovascularization because of hyperoxia-mediated vasoconstriction and hypoxic rebound[13]. Surprisingly, discriminations based on gender were not significantly associated with ROP incidence (p = 0.98), which was also consistent with the findings of several other studies indicating mixed or non-significant gender differences[14]. In terms of severity, most cases were mild, with Stage 1 and Stage 2 accounting for nearly 80% of the total. No cases of advanced ROP (Stage 4 or 5) were observed, likely due to early screening and timely referral protocols currently in place at our tertiary care center[15,16]. This finding suggests that current screening strategies are reasonably effective at identifying ROP in its earlier, more treatable stages. This study provides updated local data on ROP frequency in a high-risk preterm population. However, certain limitations should be acknowledged. The single-center design limits generalizability, and the use of non-probability sampling may introduce selection bias. Moreover, long-term outcomes of infants with ROP were not assessed, and potential confounders such as maternal health status and perinatal infections were not included.

CONCLUSION

It is concluded that retinopathy of prematurity (ROP) remains a significant complication among preterm infants born before 34 weeks of gestation, with a frequency of 15.3% in this study population. Lower gestational age, low birth weight, and the administration and duration of supplemental oxygen were identified as significant risk factors for the development of ROP. The majority of cases were diagnosed at early stages, highlighting the effectiveness of timely screening.

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