Original Article

Frequency of Retinopathy of Prematurity in Premature and Very Low Birth Weight Infants

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ABSTRACT

Purpose: To determine the prevalence of retinopathy of prematurity (ROP) in premature and very low birth weight infants.

Study Design: Descriptive Observational study.

Place and Duration of Study: Department of Paediatric Medicine at Recep Tayyip Erdogan Hospital, Muzaffargarh, from 26th November 2024 to 25th May 2025.

Methods: A total of 172 infants born at ≤ 32-weeks of gestation and weighing ≤ 1500 grams birth weight were consecutively included in the study.Data regarding age, gender, gestational age, birth weight, duration of oxygen therapy, need for surfactants and mechanical ventilation was collected. Fortnightly eye examinations were performed by ophthalmologist. Factors associated with ROP were determined through chi-square test at 5% significance level using SPSS version 27.

Results: Of all the participants, 52.3% (n=90) were males. The mean gestational age and birth weight were 29.3 ± 1.4 weeks and 1123.4 ± 131.6 grams. The surfactant therapy was required in 61% (n=105) and mechanical ventilation in 56.4% (n=97). The mean duration of oxygen therapy was 9.6 ± 5.0 days. Retinopathy of prematurity was diagnosed in 30.2% (n=52) of infants. Frequency of ROP was significantly high in infants with gestational age of < 30-weeks (40%), birth weight of ≤ 1000 grams (59.6%), infants receiving mechanical ventilation (48.5%) and oxygen therapy for > 10-days (71%).

Conclusion: Significant proportion of infants developed ROP. Lower gestational age and birth weight with need for mechanical ventilation and prolonged oxygen therapy are significantly associated with ROP.

Keywords: Premature, Birth weight, Retinopathy of prematurity, Surfactant.

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INTRODUCTION

One of the common eye conditions in preterm infants is retinopathy of prematurity (ROP). Severe ROP can cause retinal detachment and blindness if left untreated. According to global data, up to 15 million babies are born prematurely per year.[1] There are an estimated 50,000 children worldwide,who are blind due to ROP.[2,3] Long-term structural and functional visual problems are common in neonates with ROP. Refractive errors and strabismus are examples of structural problems, while mild to severe visual impairment, including blindness, diminished contrast sensitivity, visual field abnormalities, and incorrect colour vision and perception are examples of functional complications.[4] ROP related blindness can be avoided with excellent newborn care, and early diagnosis.[5]

There is a strong correlation between the degree of

prematurity at birth and the occurrence and severity of ROP. Neonates with a birth weight <1500 grams and gestational age <32 weeks account for majority of the cases.[6] Compared to developed countries, the prevalence of ROP and blindness is significantly more in developing countries.[7] High rates of preterm delivery, lack of knowledge of ROP, shortage of qualified staff, budgetary limitations, and the absence of screening and treatment programs in many neonatal facilities are the major reasons.[7] Taqui AM et al, studied frequency of ROP in a study conducted in Karachi, Pakistan where they observed that out of the 68 infants, 22 (32.4%) developed ROP.[8]

Pakistan is a developing country with high population growth rate, poor health resources and a high neonatal mortality rate. With increasing burden of premature deliveries, higher number of premature babies are expected to face the problem of childhood blindness due to ROP. It is necessary time and again to investigate the burden of ROP in our population. This study will help re-allocating the resources including skilled personnel for early detection and prompt treatment of the condition and launch the awareness programs among healthcare professionals and to encourage the implementation of suitable treatment strategies.

METHODS

This descriptive observational study was conducted in the Department of Paediatric Medicine at Recep Tayyip Erdogan Hospital, Muzaffargarh over a period of six months from 26th November 2024 to 25th May 2025, after approval from the institutional ethics review committee **(IRB# IHHN_IRB_2024_12_010, dated 25th November 2024)**. Infants born at ≤ 32-weeks of gestational age and ≤ 1500 grams weight at birth were consecutively included in the study after parental informed consent. Infants lost to follow-up before 12-weeks of postnatal age or dying before sufficient eye examinations were excluded from the study.

Data on postnatal age (weeks), gestational age (weeks), birth weight (grams), current weight (grams), gender, need for surfactant therapy, need for mechanical ventilation and duration of oxygen therapy (days) was collected on the predesigned proforma. All the infants were followed fortnightly in the OPD and examined by consultant ophthalmologist for assessment of ROP. Indirect ophthalmoscopy was performed dilated pupils (using 0.5% tropicamide and 0.5% phenylephrine eye drops).All the infants with ROP were later managed by an experienced ophthalmologist as per hospital protocol.

A sample size of 172 premature infants was calculated taking 32.4% frequency of ROP,[8] 95% confidence level and 7% absolute precision through Open Epi online software using single proportion formula. Statistical Package for the Social Sciences (SPSS) version 23 for data analysis was used. The normality of numerical data was checked through Shapiro-Wilk test. We calculated mean ± standard deviation for postnatal age, gestational age, current weight, birth weight and duration of oxygen therapy. Frequency and percentages were calculated for gender, need for mechanical ventilation, surfactant therapy and presence of ROP. For assessment of factors associated with ROP, we converted the numerical variables into dichotomous variables. The variables between infants with and without ROP were compared through chi-square test and p-value < 0.05 was considered significant.

RESULTS

The study enrolled 172 infants including 52.3% (n=90) males. The gestational age, birth weight, postnatal age and current weight are presented in Table 1.The surfactant therapy was required in 61% (n=105) and mechanical ventilation in 56.4% (n=97). ROP was detected in 30.2% (n=52). Details are shown in Table 1.

Frequency of ROP was significantly high in infants born < 30-weeks of gestation, birth weight of ≤ 1000 grams, who received mechanical ventilation and infants receiving oxygen therapy for more then 10-days**(Table 2).**

Table 1: *Characteristics of premature and very low birth weight infants (N=172).*

Postnatal age (weeks)	mean ± SD	9.1 ± 1.6
Current Weight (grams)	mean ± SD	2257.6±249.5
Gestational Age (weeks)	mean ± SD	29.3±1.4
Birth Weight (Grams)	mean ± SD	1123.4±131.6
Gender	n (%)	
Male		90 (52.3)
Female		82 (47.7)
Need for Surfactant therapy – Yes	n (%)	105 (61)
Need for mechanical ventilation–Yes	n (%)	97 (56.4)
Days on oxygen therapy	mean ± SD	9.6 ± 5.0
Retinopathy of Prematurity – Yes	n (%)	52 (30.2)

Table 2: *Factors associated with retinopathy of prematurity in premature and very low birth weight infants (N=172).*

Factors		Retinopathy of prematurity		p-value*
		Yes	No	
Gender	Male	29 (32.2)	61 (67.8)	0.552
	Female	23 (28)	59 (72)	
Gestational Age	< 30-weeks	36 (40)	54 (60)	0.003
	≥ 30-weeks	16 (19.5)	66 (80.5)	
Birth Weight (grams)	≤ 1000	28 (59.6)	19 (40.4)	< 0.001
	1000 - 1500	24 (19.2)	101 (80.8)	
Need for surfactant	Yes	33 (31.4)	72 (68.6)	0.669
	No	19 (28.4)	48 (71.6)	
Need for mechanical ventilation	Yes	47 (48.5)	50 (51.5)	< 0.001
	No	5 (6.7)	70 (93.3)	
Days of oxygen therapy	3-5	1 (2.3)	43 (97.7)	< 0.001
	6-10	7 (10.6)	59 (89.4)	
	> 10	44 (71)	18 (29)	

*chi-square test (Fischer's exact test where cell count < 5)

DISCUSSION

One of the main causes of avoidable childhood blindness in both the developed and developing countries is ROP. As newborn care has improved, the disease's incidence has increased. Several countries have implemented early screening programs to identify and treat premature newborns with this blinding condition. Almost one third of our study participants had developed ROP. The frequency of the disease has been varied in different studies. Lower frequency was reported in developed countries ranging from 1.4 to 29.2%.[9,10,11] However, other studies revealed higher incidence ranging from 64.7 to 71%.[12,13,14] Rauf A et al, from Lahore, Pakistan, observed the prevalence of ROP in 43 out of 160 preterm babies (26.87%).[15] Mirza BH et al, found ROP in 20 out of 85 (23.5%) premature babies born before 34 weeks of gestation.[16] In 2018, Holmstrom G et al, from Sweden, studied frequency of ROP in preterm newborns where it was seen in 31.9% (1829/5734) of all neonates with gestational age (GA) of <31 weeks at the time of delivery.[17]

These variations among different studies might be because of different gestational age, birth weight, survival rate of newborns, and quality of perinatal care. It also varied among different races, geographical areas, and countries. In addition, late retinal screening in developing countries may have missed the diagnosis of ROP.[18] Socioeconomic status and differences in resources might influence protocols and the ability to screen patients, which in turn influence outcomes and reported incidences.[18]

We found high frequency of ROP in infants < 30-weeks of gestation and birth weight of ≤ 1000 grams. Consistent with our findings, Bassiouny et al, observed that the mean gestational age and birth weight of neonates with ROP were 30.9 ± 2.1 weeks and 1414 ± 339 grams, respectively, which were significantly less than those without ROP.[14]

Badeeb N et al, conducted a study where the mean birth weight was 1086.8 ± 266.6 g, and mean gestational age for the entire study group was 28.0 ± 2.4 weeks.[11] None of the neonates receiving treatment had a birth-weight >1000 g (range: 527–1000 g) or a gestational age >30 weeks (range: 23–30 weeks).[13] The frequency of ROP was 27.28% (n = 543) in an Iranian study.[19] Multivariate analysis showed that ROP was substantially correlated with gestational age and birth weight (P<0.0001 and P<0.0001, respectively).[19] The severity of ROP depends on the oxidative damage, because of immature vascularization[20] and some prenatal conditions e.g., sepsis and hyperoxia and hypoxia.[21]

We identified a strong association between oxygen delivery and ROP. Infants who received mechanical ventilation and oxygen therapy for more than ten days had higher frequency of ROP. This association had already been described in other studies in which oxygen was reported as a risk factor.[16,22] Moreover, there was a significant association between duration of oxygen therapy, high oxygen pressure, and retinopathy.[23] Initially low tissue oxygen levels upregulate vascular endothelial growth factor (VEGF) and oxygen therapy downregulates VEGF due to hyperoxia.[24] Reduced retinal VEGF in premature newborns exposed to hyperoxia prevents normal

vessel formation, leading to avascular retina. The avascular retina's area increases with an infant's level of immaturity. In addition to halting vessel formation, prolonged exposure to high oxygen levels causes vasoconstriction and, ultimately, vaso-obliteration. This lack of normal vessel growth leaves the peripheral retina without adequate blood supply and later ROP.[24]

Many countries have implemented their screening protocol for timely detection and management of preterm neonates suffering from this condition. The guidelines for ROP screening have been shown to be inadequate for screening in low/middle-income countries. Ophthalmological society of Pakistan has developed ROP screening criteria for local population.[25] Further studies using local criteria are needed which may show a higher frequency of ROP.

In this study, nearly one-third of premature and very low birth weight infants developed retinopathy of prematurity, with significantly higher frequency among those with lower gestational age, lower birth weight, prolonged oxygen therapy, and the need for mechanical ventilation. These findings align with international data and highlight the importance of targeted screening in high-risk neonates. However, the study's single-center design, relatively short duration, and omission of certain perinatal and maternal factors may limit the generalizability of results and the ability to establish causality. Future multicenter studies with larger cohorts, extended follow-up, and a more comprehensive set of risk variables are warranted to better define the burden of ROP and to develop preventive strategies tailored to local healthcare contexts.

CONCLUSION

A substantial proportion of premature and very low birth weight infants in this cohort developed ROP, particularly those with lower gestational age, extremely low birth weight, prolonged oxygen exposure, and need for mechanical ventilation. These findings emphasize the need for vigilant, timely screening of high-risk neonates to enable early detection and intervention.

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Patient's Consent: Researchers followed the guidelines set forth in the Declaration of Helsinki.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board **(IHHN-IRB-2024-12-010)**.

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Authors Designation and Contribution

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