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RESEARCH ARTICLE
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APGAR AS A RISK FACTOR FOR RETINOPATHY OF PREMATURITY (ROP)

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Abstract

Background:

Retinopathy of prematurity (ROP) is a vasoproliferative disorder affecting developing retinal vessels in preterm infants, ranging from mild, non–vision-threatening sequelae to bilateral retinal detachment and blindness. The APGAR score, assessed at 1 and 5 minutes after birth, is a widely used index of neonatal well-being and response to resuscitation. While low birth weight and prematurity are established risk factors for ROP, the association between APGAR scores and ROP risk requires further exploration.

Methods

A total of 200 preterm infants (<36 weeks gestation, <1800 g birth weight) were evaluated. APGAR scores were recorded at 1 and 5 minutes, and fundus examination was performed using an indirect ophthalmoscope to screen for ROP.

Results

All neonates had APGAR scores ≥3 at 1 minute. Infants who developed ROP demonstrated significantly lower APGAR scores at both 1 and 5 minutes compared with those without ROP (P <0.0001).

Conclusion

Low APGAR scores at 1 and 5 minutes are significantly associated with the development of ROP in preterm infants. Routine documentation of APGAR scores and targeted screening of neonates with persistently low scores may facilitate early detection and timely intervention.

Keywords: APGAR Score, retinopathy of prematurity, preterm, infants, low birth weight

Introduction

A vaso-proliferative condition of the retina, retinopathy of prematurity (ROP) was once known as retrolental fibroplasia (RFL). This condition is more common in preterm newborns, particularly in low birth weight (LBW) neonates who are exposed to high levels of oxygen (O2). It is the primary cause of newborns' avoidable blindness.[1] Low birth weight, prematurity, oxygen administration, and a number of additional as-yet-unidentified variables are all associated with retinopathy of prematurity (ROP)[2]. It is a condition that can cause blindness in prematurely born babies. Different newborn units have varying rates of ROP [3]. According to reports, it ranges between 21% and 65.8%[4] in western research and between 34.9% to 60.1%[2] in Indian studies. The AAP and AAPOS criteria were derived from the CRYO-ROP Trial and Light-ROP Trial [5], which suggested screening for newborns weighing less than 1500g at birth or younger than 32 weeks gestation.

However, the situation in developing countries and developed countries is different.[6,7] According to studies conducted in India, the low survival rate of kids with very low birth weight and extremely low birth weight in rural and semi-urban settings is caused by the reduced occurrence of ROP in these infants. Because of this, babies born weighing less than 1501 grammes have a higher chance of having ROP in underdeveloped nations than in western ones[6,8]. The majority of studies have not recommended that neonates weighing more than 1501 grammes be included in screening programs, despite recent reports of an elevated prevalence of ROP in these infants.[9]

Multiple factors contribute to the pathogenic process that causes ROP. Prematurity, sepsis, necrotising, hyperoxia, enterocolitis, intraventricular haemorrhage (IVH), severe respiratory distress requiring mechanical ventilation, shock, prolonged ventilatory support, , hypoxia need for blood transfusion, low birth weight (LBW), prolonged exposure to oxygen, the severity of neonatal illnesses, anaemia, high ambient light, acidosis, and vitamin E deficiency are just a few of the numerous potential risk factors. However, breastfeeding was thought to have a protective effect. [10.11]

APGAR score

APGAR SCORE (Appearance, Pulse, Grimace, Activity and Respiration) provides an accepted and convenient method for reporting the status of the newborn immediately after birth and the response to resuscitation if needed. The test is generally done 1 and 5 minutes after birth and may be repeated later if the score is and remains low. Seven or more is usually considered normal, four to six is considered fairly low, and three or below is considered severely low.
A low score at 1 minute may require medical attention but does not necessarily indicate a long-term problem, particularly if score improves at 5 minutes.

METHODS

This prospective cross-sectional study was conducted at the Department of Ophthalmology, IQ City Medical College & Hospital, over an 18-month period from October 2023 to March 2025. A total of 200 preterm infants with a birth weight (BW) ≤1800 g and period of gestation (POG) <36 weeks were enrolled. Neonates were included if they were delivered and admitted directly to the hospital, while those born at home or referred from other centers, as well as infants with major congenital anomalies or ocular conditions precluding adequate fundus evaluation, were excluded.

Clinical Evaluation

The APGAR score was recorded at 1 and 5 minutes for each neonate immediately after birth. Fundus examinations were carried out between the third and fourth week of postnatal life. Pupillary dilatation was achieved with 2.5% phenylephrine and 0.5% tropicamide eye drops, following which indirect ophthalmoscopy was performed using a 20D lens and neonatal speculum. The American Academy of Pediatrics (AAP) and American Academy of Ophthalmology (AAO) 2013 guidelines for screening examination of premature infants for ROP were strictly followed.

Screening Protocol

The timing of the initial ophthalmic evaluation was determined by gestational age (GA) at birth, with the corresponding post-menstrual age (PMA) and chronological age (CA) as shown below.

Timing of the first ophthalmological examination based on gestational age at birth

Gestational Age (in weeks)	Age of first examination (in weeks) Post Menstrual Age	Age of first examination (in weeks) Chronological Age
22	31	9
23	32	8
24	31	7
25	31	6
26	31	5
27	31	4
28	32	4
29	33	4
30	34	4
>30		4

All examinations were conducted by an experienced ophthalmologist, and findings were documented systematically.

STATISTICAL ANNALYSIS

Data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Categorical variables were expressed as numbers and percentages, while continuous variables were presented as mean ± standard deviation (SD). Univariate analysis was used to assess the association of individual risk factors with ROP, followed by multivariate logistic regression analysis to identify independent predictors. A p-value <0.05 was considered statistically significant.

RESULTS

a. APGAR at 1 min

A total of 200 preterm infants were included in the study. Of these, 56 (28%) developed retinopathy of prematurity (ROP), while 144 (72%) did not. When stratified by APGAR scores, a strong association was observed between low APGAR scores and the development of ROP. Among neonates with an APGAR score <6, 29 out of 59 (49.1%) developed ROP, compared to 27 out of 141 (18.2%) of those with an APGAR score >6. This difference was highly statistically significant (p <0.0001). The odds of developing ROP were 4.08 times higher in infants with an APGAR score <6 compared to those with scores >6 (95% confidence interval [CI]: 2.29–7.27). These findings indicate that a low APGAR score at birth is a significant risk factor for the development of ROP in preterm infants. This is shown in Table 1

APGAR score	ROP present	ROP absent	p-value
<6	29	30	<0.0001
>6	27	114	

Table 1- APGAR at 1 min

b. APGAR at 5 mins

Among the 200 preterm infants with birth weight ≤1800 g, 56 (28%) developed retinopathy of prematurity (ROP), whereas 144 (72%) did not. When APGAR scores were stratified using a cutoff of 7, a significant association with ROP was observed. Of the 50 infants with APGAR scores <7, 26 (52%) developed ROP, while 24 (48%) did not. Among the 150 infants with APGAR scores >7, 30 (20%) developed ROP, and 120 (80%) remained unaffected. This distribution was highly statistically significant (p <0.001), indicating that lower APGAR scores are associated with a higher risk of ROP.

Infants with APGAR scores <7 had 4.33 times higher odds of developing ROP compared to those with APGAR scores >7 (95% CI: 2.40–7.80, p <0.001). This indicates that a low APGAR score is a strong predictor of ROP in preterm infants with birth weight ≤1800 g. This is shown in Table 2.

APGAR score among BW <=1800g	ROP present	ROP absent	p-value
<7	26	24	<0.001
>7	30	120	

Table 2- APGAR at 5 mins

Out of the 200 babies screened, APGAR at 1 min; low APGAR (<6) was found among 59 babies and high APGAR was found among 141 babies. ROP was present among 29 babies having low APGAR and 27 having high APGAR. For APGAR at 5 minutes ; low APGAR (<7) was found among 56 babies and high APGAR (>7) was found among 144 babies. ROP was found among 26 babies having low APGAR .

DISCUSSION

Gestational age and birth weight are currently the most significant risk factors for the development of ROP. 56 kids (28%), out of 200 premature infants, had a screening incidence of ROP. According to different research, the occurrence of ROP varies from 11% to 52%. This varies based on the hospital facilities that provide postnatal care for the newborns, which leads to varying survival rates in various configurations. It also depends on awareness of ROP screening at various locations. In our study, newborns with ROP had significantly lower APGAR at 1 minute (p1) and 5 minutes (p) than neonates without ROP. Compared to APGAR at 5 minutes (r2=0.61), the correlation between ROP and APGAR at 1 minute (r2=0.81) was stronger.

Similar to our work, Alajbejovic J. et al. [8] discovered that low APGAR at 1 minute (3.20±1.30) and 5 minutes (5.20±1.09) were substantially linked to the development of ROP (p=0.002 and p=0.001, respectively). Additionally, Chirico G. et al.'s study from 2009 found a strong correlation between ROP and low APGAR scores at one and five minutes (p). A poor APGAR score at 5 minutes was identified by Garcia Serrano et al. as a major and independent risk factor for the development of plus disease in prematurely born multiplets [(10)]. Nonetheless, a study by Arne M. et al. found a significant correlation between the prevalence of ROP and a poor APGAR score at one minute (p). [11]Although not very significant, APGAR at 5 minutes (p=0.05) was positively correlated with the development of ROP.

Limitations

This study has several limitations. Being a single-center study, the findings may not be generalizable to other regions or healthcare settings. The sample size, though moderate, limits the statistical power and precludes detailed subgroup analyses for extremely low birth weight or gestational age categories. Additionally, infants born at home or referred from other hospitals were excluded, potentially missing cases with different risk profiles. The observational design allows identification of associations but cannot establish causality, and the study did not include long-term follow-up to assess the progression of ROP or visual outcomes.

Future Directions

Future research should focus on multicenter studies with larger sample sizes and longitudinal follow-up to validate these findings and evaluate long-term visual outcomes. Incorporating additional clinical, biochemical, or genetic markers alongside APGAR scores may improve early risk prediction. Moreover, prospective trials examining whether early identification of high-risk infants leads to timely interventions and reduced ROP severity could further guide neonatal care practices.

Conclusion

This study demonstrates a significant association between low APGAR scores at 1 and 5 minutes and the development of retinopathy of prematurity in preterm infants with birth weight ≤1800 g. Infants with lower APGAR scores were at a markedly higher risk for ROP, emphasizing the importance of immediate postnatal assessment and careful monitoring. Recording APGAR scores and using them as part of early risk stratification can help neonatologists identify high-risk infants who require timely ophthalmologic evaluation. Early recognition and intervention in these infants may reduce the risk of severe visual impairment and improve overall neonatal outcomes.

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