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Incidence and Risk factors of Retinopathy of Prematurity at a tertiary neonatal care unit in eastern Nepal

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ABSTRACT

Introduction: Retinopathy of Prematurity (ROP) is a major cause of preventable blindness in preterm infants. This study aims to determine the incidence of ROP and associated risk factors in preterm infants in a tertiary care hospital in Nepal.

Methods: A cross-sectional study was conducted over 18 months in NICU. Preterm infants with gestational age ≤34 weeks or birth weight ≤2000 grams were screened for ROP. Maternal and neonatal data were analysed to identify risk factors.

Results: A total of 75 preterm infants were screened, with 19 (25.3%) diagnosed with ROP. Infants with ROP had significantly lower gestational ages (mean 30.52 ± 1.5 weeks) and birth weights (mean 1308.94 ± 288.98 grams) compared to those without ROP (mean gestational age 31.94 ± 1.74 weeks, mean birth weight 1646.25 ± 432.29 grams). Prolonged duration of supplemental oxygen (mean 13.47 ± 4.77 days in the ROP group) was also significantly associated with ROP (p=0.001). Mode of delivery was a significant factor, with caesarean delivery more frequent among ROP cases (p=0.016). Other factors, such as APGAR scores, neonatal jaundice, and neonatal sepsis, showed no significant association with ROP.

Conclusion: The incidence of ROP was 25.3% with low gestational age, birth weight, and prolonged oxygen use as key risk factors. Early screening is essential for timely intervention in Nepal.

INTRODUCTION

Retinopathy of Prematurity (ROP) is a leading cause of childhood blindness, primarily affecting preterm infants with low birth weight.[1] Characterized by abnormal retinal vascular development, ROP can result in vision loss if untreated. Since its identification in the 1940s, ROP has become a critical neonatal health issue, especially as improved neonatal care has increased the survival rates of preterm infants.

ROP is multifactorial, with contributing factors including prematurity, low birth weight, prolonged oxygen exposure, and neonatal complications. Although oxygen therapy is vital for survival, its mismanagement can exacerbate ROP by disrupting normal retinal vascularization. Other systemic factors, such as neonatal sepsis and respiratory distress syndrome, also play a role in ROP development.[2-5]

The incidence of ROP varies significantly between regions.[6] In high-income countries, better neonatal care practices and screening have reduced severe cases. In contrast, ROP remains a major public health concern in low- and middle-income countries (LMICs), where access to neonatal intensive care units (NICUs) and trained healthcare providers is limited, leading to higher prevalence and severity.[7]

In Nepal, the rising survival rates of premature infants have heightened the burden

of ROP amid inadequate oxygen therapy protocols and screening programs. Understanding ROP risk factors in this context is crucial for timely intervention and management.

This study aims to evaluate the incidence of ROP among preterm infants in Nepal and investigate its association with factors such as gestational age, birth weight, mode of delivery, and duration of supplemental oxygen. By identifying key risk factors, this research seeks to enhance ROP prevention and management strategies, ultimately improving neonatal outcomes and reducing preventable blindness.

METHODOLOGY

This hospital-based, prospective, cross-sectional analytical study aimed to identify the incidence and associated risk factors of Retinopathy of Prematurity (ROP) in preterm infants admitted to the neonatal intensive care unit (NICU) at a tertiary care hospital in Nepal. The study was conducted over 18 months (April 2023 to September 2024) of time. It included all preterm infants with a gestational age of ≤34 weeks or a birth weight of ≤2000 grams who were admitted to the NICU during this period. Infants with congenital anomalies or those discharged or transferred before ROP screening could be performed were excluded.

The sample size was calculated using the 22.8% incidence obtained from a previous study[8], a 5% margin of error, and a 95% confidence level, resulting in an initial sample size of 271. After adjusting for a finite population of 87, based on our previous data of 29 eligible preterm infants over the past 6 months, the final sample size was determined to be 66 participants, which could be achieved over an 18-month period.

A consecutive sampling technique was employed encompassing all eligible preterm infants admitted during the study duration. Data collection involved a thorough review of medical records and ophthalmological examinations. A structured data collection sheet was used to gather demographic and clinical information, including gestational age, birth weight, duration of supplemental oxygen, mode of delivery, and other relevant maternal and neonatal factors.

ROP screening was conducted by a trained ophthalmologist using indirect ophthalmoscopy. The initial examination occurred when the infant reached 4-6 weeks of life or 31-33 weeks of postmenstrual age, whichever was later. Follow-up examinations were scheduled according to the initial screening findings, adhering to international ROP screening guidelines.

Data analysis was performed using SPSS software. Statistical analysis involved using the independent samples t-test for continuous variables (e.g., gestational age, birth weight), and the Mann-Whitney U test for non-normally distributed data (e.g., APGAR score). Categorical variables were compared using the chi-square or Fisher's exact test, with $p < 0.05$ considered statistically significant. Logistic regression analysis was used to assess the association between ROP and key risk factors, with odds ratios (OR), 95% confidence intervals (CI), and p-values calculated.

Ethical approval was obtained from the institutional review board prior to data collection. Written informed consent was secured from the parents or guardians of all participating infants before any ophthalmological examinations. The confidentiality of participants' information was maintained, and the data were exclusively used for research purposes.

RESULTS

In this study, 103 preterm infants were enrolled. However, 28 patients were excluded from the final analysis due to factors such as incomplete data, neonatal death, and leave against medical advice or failure to meet the inclusion criteria. Ultimately, 75 infants remained eligible and were included in the analysis, where 19 (25.3%) were diagnosed with ROP, while 56 (74.7%) were not. Significant differences were observed between infants with ROP and those without ROP in terms of gestational age, birth weight, and the duration of supplemental oxygen. Infants with ROP had a significantly lower gestational age (30.52 ± 1.5 weeks vs. 31.94 ± 1.74 weeks, $p = 0.002$), lower birth weight (1308.94 ± 288.98 grams vs. 1646.25 ± 432.29 grams, $p = 0.002$), and required a longer duration of supplemental oxygen (13.47 ± 4.77 days vs. 8.71 ± 5.44 days, $p = 0.001$).

Regarding the distribution of ROP based on birth weight, most cases occurred in infants weighing between 1001-1500 grams (13 out of 28, 46.42%), while no infants weighing over 2000 grams developed ROP. Similarly, gestational age was a key factor, with most cases occurring in infants born between 29-32 weeks (18 out of 48, 37.5%), and no cases observed in infants born after 33 weeks.

Other clinical variables showed no significant associations with ROP, including gender ($p = 0.463$), birth asphyxia ($p = 0.836$), resuscitation at birth ($p = 0.851$), multiple gestations ($p = 0.645$), and various maternal conditions such as premature rupture of membranes, pregnancy-induced hypertension, and antepartum hemorrhage. However, mode of delivery was a significant factor, with a higher proportion of ROP cases occurring in infants delivered via cesarean section ($p = 0.016$). While neonatal sepsis and blood transfusion were marginally associated with ROP ($p = 0.08$ and $p = 0.052$, respectively), other neonatal complications like respiratory distress syndrome (RDS), neonatal jaundice, and the use of inotropes did not show significant correlations.

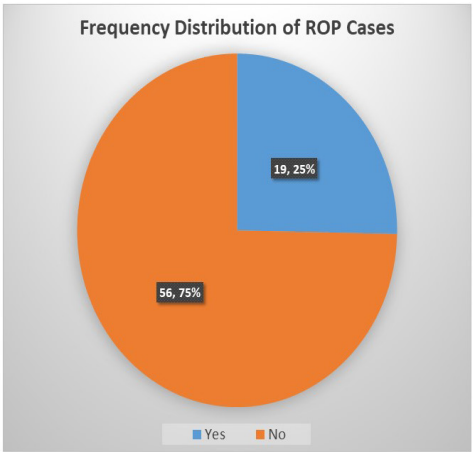

Figure 1: Frequency distribution between Infants with and

without ROP

Table 1: Comparison of Neonatal Characteristics between Infants with and without ROP

Variables Yes		ROP		P-Value
		No	Yes	
Gestational Age in weeks (Mean ± SD)		30.52 ± 1.5	31.94 ± 1.74	0.002
Birth Weight in grams (Mean ± SD)		1308.94 ± 288.98	1646.25 ± 432.29	0.002
Duration of Supplemental Oxygen in days (Mean ± SD)		13.47 ± 4.77	8.71 ± 5.44	0.001
APGAR at 5 mins (Median (IQR))		8 (8-9)	8 (8-9)	0.493
Duration of Hospital Stay in days (Mean ± SD)		19.36 ± 7.38	17.33 ± 8.27	0.346
Gender (n)	Male	6	23	0.463
	Female	13	33	
Mode of Delivery (n)	Caesarean	13	51	0.016
	Vaginal	6	5	

Table 2: Distribution of Birth Weight among Preterm Infants with and without ROP

Birth Weight (grams)	ROP		Total (n)
	Yes (n)	No (n)	
≤ 1000	3	5	8
1001 – 1600	13	25	38
1601 – 2000	3	22	25
> 2000	0	4	4

Table 3: Distribution of Gestational Age among Infants with and without ROP

Gestational Age (Weeks)	ROP		Total (n)
	Yes (n)	No (n)	
≤ 28	1	3	4
29 – 30	7	7	14
31 – 32	11	21	32
33 – 34	0	25	25

Table 4: Comparison of Maternal and Neonatal Risk Factors between Infants with and without ROP

Variables (n)	ROP		p – value
	Yes	No	
Birth Asphyxia	2	5	0.836
Resuscitation at Birth	6	19	0.851
Multiple Gestations	7	24	0.645
Premature Rupture of membrane	4	18	0.359
Oligohydramnios	0	7	0.106
Eclampsia	0	2	0.404
Use of Steroids	10	32	0.732
Ante Partum Hemorrhage	1	7	0.377
Gestational Diabetes Mellitus	0	4	0.231
Respiratory Distress Syndrome	18	45	0.14
Neonatal Sepsis	16	35	0.08
Neonatal Jaundice	13	33	0.463
IUGR	3	9	0.977
Necrotising Enterocolitis	4	7	0.363
Patent Ductus Arteriosus	2	3	0.435
Atrial Septal Defect	0	1	0.558
Blood Transfusion	12	21	0.052
Surfactant Therapy	11	19	0.065
Intraventricular Hemorrhage	1	0	0.084
Mechanical Ventilation	4	18	0.359

Table 5: Logistic Regression Analysis of Risk Factors for ROP

Risk Factor	ROP		
	OR	95% CI	P-value
Birth Weight <1600 grams	3.467	0.814 – 14.769	0.093
Gestational Age <30 weeks	2	0.579- 6.908	0.273

Table 5 presents the odds ratios (OR), 95% confidence intervals (CI), and p-values for the association between two risk factors and the development of ROP. In the model, Birth weight <1600 grams was associated with a higher odds ratio (OR = 3.467), suggesting an increased likelihood of ROP, though it did not reach statistical significance (p = 0.093). Gestational age <30 weeks showed a similarly increased odds ratio (OR = 2.000), but this too was not statistically significant (p = 0.273). Both confidence

intervals include 1, indicating that these risk factors were not statistically significant predictors of ROP in this analysis.

DISCUSSION

This study provides insight into the incidence and risk factors for Retinopathy of Prematurity (ROP) among preterm neonates in the NICU at Birat Medical College Teaching Hospital, aligning with global trends in ROP research. The study underscores the strong association between lower birth weight, shorter gestational age, and the development of ROP, although these findings did not reach statistical significance, likely due to the small sample size.

Our research emphasizes the importance of systematic ROP screening, particularly in resource-limited settings like Nepal, where inconsistent screening protocols persist. International guidelines recommend screening preterm infants with birth weights <1500 grams or gestational ages <32 weeks, and our study's focus on infants <1600 grams and <30 weeks supports the importance of these risk factors in high-risk groups. The statistically significant trends in our findings align with larger studies like CRYO-ROP[9] and ETROP[10], which have consistently identified low birth weight and gestational age as the strongest predictors for ROP. Other studies that have consistently yielded similar results.[11-14]

Nepal faces a unique set of challenges in ROP management due to limited infrastructure, inconsistent screening, and a lack of access to specialized ophthalmologic care. Despite advancements in neonatal care, the gap in awareness and adherence to screening guidelines among paediatricians is notable, as highlighted by Shrestha et al.'s study, which showed only 28.4% of paediatricians were aware of the correct screening timelines.[15] This emphasizes the need for improved education and standardized screening protocols in Nepal.

The incidence of ROP in our study closely parallels findings from Vasavada et al. in Western India, with any-ROP in 19.28% of babies and severe-ROP in 10.29%.[16] Our study similarly identified a significant proportion of infants at risk, suggesting a consistent prevalence of ROP in preterm infants across South Asia, likely due to common neonatal care challenges.

Oxygen therapy was a notable risk factor in the study by Vasavada et al.[16], increasing the likelihood of any-ROP threefold (OR 3.0) and severe-ROP sevenfold (OR 7.0). In our study, the duration of supplemental oxygen therapy was significantly longer in infants with ROP (mean 13.47 days) compared to those without. Our findings also emphasized the significant impact of low birth weight (<1600 grams) and gestational age (<30 weeks). Prolonged oxygen exposure remains a critical factor in ROP development, underscoring the importance of careful oxygen management in preterm neonates.

Our study's ROP incidence aligns with regional data, such as Yadav et al.[8] in Nepal, where 22.8% of preterm neonates had ROP, with 13% at stage-1, 6.5% at stage-2, and 3.3% at stage-3, closely mirroring the severity seen in our patients. This consistency, along with Vasavada et al.'s findings in Western India[16], highlights similar ROP prevalence and risk factors across South Asia, primarily linked to low birth weight, prematurity, and oxygen exposure.

Both our study and Yadav et al.[8] identified low birth weight and gestational age as key risk factors for ROP, with Yadav's data showing significant associations (birth weight OR 2.9; gestational age OR 3.9). Oxygen exposure, also noted as a major contributor, was highlighted in Vasavada et al.'s study, where it increased the risk of severe ROP sevenfold. These findings reinforce the need for strict oxygen monitoring in NICUs.

Interestingly, while mode of delivery showed a significant association with ROP incidence (p=0.016), factors such as APGAR scores, birth asphyxia, and resuscitation at birth did not demonstrate significant relationships. The higher incidence of ROP in infants born via caesarean section may suggest that surgical delivery is more frequently performed in cases where complications are anticipated, leading to the delivery of more vulnerable infants. This relationship warrants further investigation to elucidate the underlying mechanisms and implications for clinical practice.

Other maternal and neonatal factors, including pregnancy-induced hypertension, multiple gestations, and interventions like surfactant therapy, were not significantly associated with ROP in our study. This lack of significant correlation may reflect the specific demographics of our study population or the limited sample size. However, it emphasizes the need for continued research to explore the multifactorial nature of ROP and how different contexts may influence outcomes.

To reduce the incidence of ROP in Nepal, there is an urgent need for increased awareness among healthcare providers, standardized national screening protocols, and improved neonatal care infrastructure. Timely screening, judicious oxygen use, and better referral systems are critical steps toward mitigating ROP-related blindness in the country.

LIMITATIONS OF THE STUDY

The absence of statistically significant results in this study does not negate the importance of ROP screening. Instead, it underscores the need for larger, multicentre studies in Nepal and similar settings to better quantify the incidence and predictors of ROP. Additionally, further research into other potential risk factors such as neonatal sepsis, mechanical ventilation, and inotropic support, which were considered in our logistic regression model but did not show significant results, should be pursued.

CONCLUSION

Our study, along with findings from other research in Nepal and the South Asian region, highlights the significant burden of ROP in preterm neonates and the importance of early screening, effective management, and systemic improvements in neonatal care. Consistent risk factors, such as low birth weight, gestational age, and prolonged oxygen therapy, have been identified across multiple studies, underscoring the need for standardized care protocols. Addressing knowledge gaps, enhancing infrastructure, and improving referral systems are crucial for reducing the incidence of ROP-related blindness in Nepal.

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CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

REFERENCES

1. Wheatley CM, Dickinson JL, Mackey DA, Craig JE, Sale MM. Retinopathy of prematurity: recent advances in our understanding. Br J Ophthalmol. 2002 Jun;86(6):696-700. DOI: 10.1136/bjo.86.6.696 PMID: 12034695 PMCID: PMC1771164

2. Kumar P, Sankar MJ, Deorari A, et al. Risk factors for severe retinopathy of prematurity in preterm low birth weight neonates. Indian J Pediatr. 2011;78(7):812-816. DOI: 10.1007/s12098-011-0363-7 PMID: 21340729

3. Isaza G, Arora S, Bal M, Chaudhary V. Incidence of retinopathy of prematurity and risk factors among premature infants at a neonatal intensive care unit in Canada. J Pediatr Ophthalmol Strabismus. 2013;50(1):27-32. DOI: 10.3928/01913913-20121127-02 PMID: 23205771

4. Alizadeh Y, Zarkesh M, Moghadam RS, et al. Incidence and Risk Factors for Retinopathy of Prematurity in North of Iran. J Ophthalmic Vis Res. 2015;10(4):424-428. DOI: 10.4103/2008-322X.176907 PMID: 27051487 PMCID: PMC4795392

5. Li ML, Hsu SM, Chang YS, et al. Retinopathy of prematurity in southern Taiwan: a 10-year tertiary medical center study. J Formos Med Assoc. 2013;112(8):445-453. DOI: 10.1016/j.jfma.2012.03.002 PMID: 24016609

6. Martin JA, Kochanek KD, Strobino DM, Guyer B, MacDorman MF. Annual summary of vital statistics--2003. Pediatrics. 2005;115(3):619-634 DOI: 10.1542/peds.2004-2695 PMID: 15741364

7. Drack AV. Preventing blindness in premature infants. N Engl J Med. 1998;338(22):1620-1621. DOI: 10.1056/NEJM199805283382210 PMID: 9603802

8. Yadav R, Gupta S, Shrestha JB, Yadav R, Yadav TBS. Perinatal Risk Factors for Retinopathy of Prematurity in Preterm and Low Birth Weight Neonates. Nepal J Ophthalmol. 2020 Jan;12(23):32-38. DOI: 10.3126/nepjoph.v12i1.28625 PMID: 32799237

9. Schaffer DB, Palmer EA, Plotsky DF, Metz HS, Flynn JT, Tung B, Hardy RJ. Prognostic factors in the natural course of retinopathy of prematurity. The Cryotherapy for Retinopathy of Prematurity Cooperative Group. Ophthalmology. 1993 Feb;100(2):230-7. DOI: 10.1016/S0161-6420(93)31665-9 PMID: 8437832

10. Good WV, Hardy RJ, Dobson V, Palmer EA, Phelps DL, Quintos M, Tung B; Early Treatment for Retinopathy of Prematurity Cooperative Group. The incidence and course of retinopathy of prematurity: findings from the early treatment for retinopathy of prematurity study. Pediatrics. 2005 Jul;116(1):15-23. DOI: 10.1542/peds.2004-1413 PMID: 15995025

11. Akkoyun I, Oto S, Yilmaz G, Gurakan B, Tarcan A, Anuk D, Akgun S, Akova YA. Risk factors in the development of mild and severe retinopathy of prematurity. J AAPOS. 2006 Oct;10(5):449-53. DOI: 10.1016/j.jaapos.2006.05.007 PMID: 17070481

12. Alajbegovic-Halimic J, Zvizdic D, Alimanovic-Halilovic E, Dodik I, Duvnjak S. Risk Factors for Retinopathy of Prematurity in Premature Born Children. Med Arch. 2015 Dec;69(6):409-13. DOI: 10.5455/medarh.2015.69.409-413 PMID: 26843736 PMCID: PMC4720470

13. Akçakaya AA, Yaylali SA, Erbil HH, Sadigov F, Aybar A, Aydin N, Akçay G, Acar H, Mesçi C, Yetik H. Screening for retinopathy of prematurity in a tertiary hospital in Istanbul: incidence and risk factors. J Pediatr Ophthalmol Strabismus. 2012 Jan-Feb;49(1):21-5. DOI: 10.3928/01913913-20110208-01 PMID: 21323244

14. Adhikari S, Badhu BP, Bhatta NK, Rajbhandari RS, Kalakheti BK. Retinopathy of prematurity in a tertiary care hospital in eastern Nepal. JNMA J Nepal Med Assoc. 2008 Jan-Mar;47(169):24-7. DOI: 10.31729/jnma.213 PMID: 18552888

15. Shrestha P, Mathema S, Pradhan PMS. Knowledge and practice regarding retinopathy of prematurity among paediatricians. J Kathmandu Med Coll. 2022;11(4):197-203 DOI: 10.3126/jkmc.v11i4.53546

16. Vasavada D, Sengupta S, Prajapati VK, Patel S. Incidence and risk factors of retinopathy of prematurity in Western India-Report from A Regional Institute of Ophthalmology. Nepal J Ophthalmol. 2017 Jul;9(18):112-1120. DOI: 10.3126/nepjoph.v9i2.19254 PMID: 29634699