Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

Clinical Profile and Risk Factor Analysis of Retinopathy of Prematurity: A Hospital-Based Observational Study from North Karnataka

1) Dr Chaya K A, 2) Dr Rohit A, 3)Dr.Suheena.C, 4) Dr Prakash Wari,5) Dr. Diganth C Divya

Associate Professor,Department of Pediatrics,JJM Medical College ,
Davanagere ,Karnataka,Mobile: 98451-79546
Email: chaya.ka247@gmail.com

Associate Professor,Dept of Community Medicine,JJM Medical College
MCC A block,Davanagere 577004,Karnataka
drrohita@gmail.com,9738361471

Senior resident ,JJM Medical College ,Davanagere ,Karnataka
Mob number: 9916637172,Email id : suheena.chaman@gmail.com

Professor and former Head,Department of Pediatrics,KIMS RC , Hubli
Karnataka,Mob no: 94480 63128
Email :pkwari@rediffmail.com

5*) [Corresponding Author]*:Dr. Diganth C Divya
Associate professor,Dept of Community Medicine,Srinivas institute of medical science
Mukka, Mangalore,Karnataka,9482669838
dr.diganth.divya@gmail.com

ABSTRACT:

Background: Retinopathy of prematurity (ROP) is a significant cause of preventable childhood blindness, particularly affecting premature infants in developing countries. With improved survival rates of preterm infants, understanding its risk factors and clinical profile is crucial for early detection and management.

Objective: To investigate the incidence, risk factors, and staging of ROP in preterm babies admitted to the NICU at Karnataka Institute of Medical Sciences, Hubli.

Methods: A hospital-based observational study was conducted from December 2012- November 2013. Preterm infants ≤34 weeks gestational age and/or birth weight ≤2000 grams were screened for ROP. Detailed maternal and neonatal data were collected, and ROP screening was performed using indirect ophthalmoscopy. Statistical analysis included descriptive statistics, chi-square tests, and unpaired t test.

Results: Of 176 screened preterm infants, 71 (40.3%) developed ROP. Stage II was predominant (73.2%) followed by Stage I (26.8%), with no advanced stages observed. Significant risk factors included lower gestational age (p=0.0002), birth weight <1500g (p=0.024), multiple gestation

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

($p<0.001$), oxygen therapy ($p<0.001$), sepsis (83.1% vs 17.1%, $p<0.001$), respiratory distress syndrome (50.7% vs 15.2%, $p<0.001$), and apnea (19.7% vs 4.8%, $p=0.001$). Laboratory parameters showed significantly higher infection markers in the ROP group, with increased CRP and blood culture positivity ($p<0.001$). Most cases (88.7%) showed spontaneous resolution, with only 5.6% requiring intervention.

Conclusion: The study demonstrated a significant ROP incidence of 40.3%, with multiple risk factors identified. Strong associations were found between ROP development and lower gestational age, birth weight, multiple gestation, oxygen therapy, and neonatal complications, particularly sepsis.

Keywords: Retinopathy of prematurity, preterm infants, risk factors, birth weight, gestational age, sepsis, oxygen therapy, NICU, screening, India

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

INTRODUCTION:

Globally, more than 10% of babies are born prematurely (15 million), requiring special care for survival.[1] Over 80% of newborn deaths are due to preventable and treatable conditions.[2] Major causes of neonatal mortality include low birth weight (LBW), prematurity, infections, birth asphyxia, and birth trauma.[3,4]

Of the estimated 1.4 million blind children worldwide (1 million in Asia, 300,000 in Africa), retinal diseases account for 25% of cases.[5] Retinopathy of prematurity (ROP) is emerging as a significant cause of childhood blindness in high- and middle-income countries and is expected to become prominent in Asia over the next decade.[5,6]

ROP is a multi-factorial vasoproliferative retinal disorder, with prematurity being the primary risk factor. Additional risk factors include low birth weight (LBW), very low birth weight (VLBW), extremely low birth weight (ELBW), unmonitored oxygen therapy, sepsis, apnea, blood transfusion, and prolonged mechanical ventilation.[7] Infants weighing <1,250 grams have a 65% risk of developing ROP, increasing to 80% for those <1,000 grams.[8]

Approximately 50,000 children worldwide are blind due to ROP, predominantly in India and Latin America.[9] ROP accounts for 15% of childhood blindness in industrialized countries.[10] Indian studies report ROP incidence in LBW babies ranging from 38% to 51.9%.[8] The incidence is rising due to improved survival rates of "at-risk" preterm infants.[7]

Since ROP is asymptomatic in early stages, regular screening of "at-risk" infants is recommended to minimize visual loss.[7] Pediatric eye care requires specific expertise, equipment,

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

and long-term follow-up.[5] ROP detection and treatment programs are expanding across Latin America, Eastern Europe, and urban areas of China, India, and other Asian countries.[1,5,11]

The economic burden of ROP-induced blindness significantly impacts a country's GDP, though screening and management costs are lower than productivity losses.[12] Given the high incidence of ROP (up to 35%) reported in South Indian studies[13] this study aims to investigate the incidence, risk factors, and staging of ROP in preterm babies admitted to NICU, KIMS, Hubli, to promote awareness among neonatologists and ophthalmologists for creating a blindness-free society.

Methodology:

A hospital-based observational study was conducted at Karnataka Institute of Medical Sciences, Hubli, from December 2012 to November 2023. The Institutional Ethics Committee approval was obtained prior to study initiation. Preterm infants with gestational age ≤34 weeks and/or birth weight ≤2000 grams admitted to the Neonatal Intensive Care Unit (NICU) were included in the study. Infants who died before initial screening, those with major congenital anomalies, and those whose parents refused consent were excluded.

Detailed maternal and neonatal data were collected using a structured proforma. Maternal factors included age, parity, mode of delivery, pregnancy complications, and antenatal steroid administration. Neonatal parameters included gestational age, birth weight, gender, APGAR scores, respiratory support requirements, oxygen therapy duration, sepsis episodes, blood transfusions, and phototherapy history.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

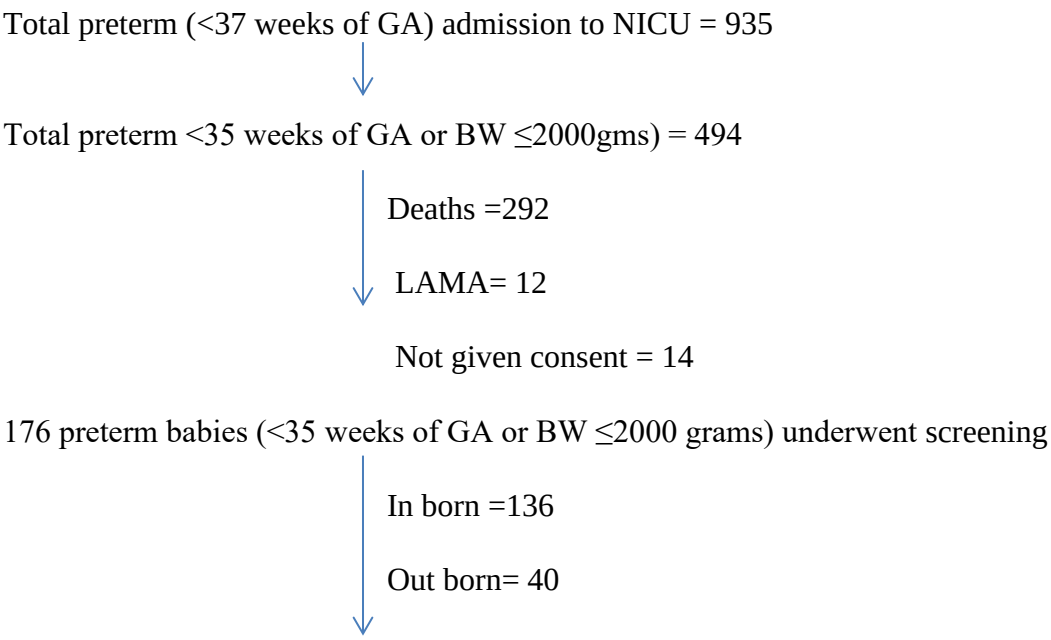
ROP screening was performed by a qualified ophthalmologist using indirect ophthalmoscopy at 4 weeks of age or 31-33 weeks post-conceptional age, whichever was later. Pupils were dilated using 0.5% tropicamide and 2.5% phenylephrine eye drops. The International Classification of ROP (ICROP) was used for staging. Follow-up examinations were scheduled based on retinal findings until complete vascularization or disease regression.

Data analysis was performed using SPSS version 21.0. Descriptive statistics were presented as frequencies, percentages, means, and standard deviations. Chi-square test was used for categorical variables, and Student's t-test for continuous variables. P-value <0.05 was considered statistically significant.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

RESULTS:

In our study out of 935 total preterm admissions to NICU, 494 were <35 weeks GA or ≤2000g BW. After accounting for deaths (292), LAMA (12), and consent refusals (14), 176 preterm babies underwent ROP screening. Of these, 136 were inborn and 40 were outborn. The ROP incidence in the screened population was 40.3% (71 babies), while 59.7% (105 babies) did not develop ROP.



ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

Table 1: Distribution of ROP cases according to stages

Stage	Number	Percentage
Stage I	19	26.8%
Stage II	52	73.2%
Stage III-V	0	0

Among the 71 babies who developed ROP, Stage II was predominant with 52 cases (73.2%), followed by Stage I with 19 cases (26.8%). Notably, there were no advanced cases (Stages III-V), suggesting early detection and possibly good management protocols. This distribution indicates that most cases were mild to moderate in severity, which aligns with the high spontaneous resolution rate seen in the outcomes. (Table 1)

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

Table 2: Demographic and clinical characteristics of study participants

Characteristics		**ROP Present (n=71)**	**ROP Absent (n=105)**	**p value**
Gender	Male	38 (53.5%)	48 (45.7%)	0.309
	Female	33 (46.5%)	57 (54.3%)	
Place of birth	Inborn	58 (81.7%)	78 (74.3%)	0.25
	Outborn	13 (18.3%)	27 (25.7%)	
Birth weight	<1000g	9 (12.7%)	6 (5.7%)	**0.024**
	1000-1500g	38 (53.5%)	43 (40.9%)	
	1500-2000g	24 (33.8%)	56 (53.3%)	
Gestational age	<28 weeks	17 (23.9%)	10 (9.5%)	**0.0002**
	28-32 weeks	41 (57.7%)	47 (44.8%)	
	>32 weeks	13 (18.3%)	48 (45.7%)	

Gender distribution showed no significant difference (p=0.309), with males slightly more represented in the ROP group (53.5% vs 45.7%). Place of birth (inborn vs outborn) also showed no significant difference (p=0.25). However, birth weight showed significant correlation (p=0.024), with higher ROP prevalence in very low birth weight babies (<1000g). Gestational age demonstrated a highly significant association (p=0.0002), with babies <28 weeks having notably higher ROP risk. The decreasing trend of ROP with increasing gestational age (>32 weeks) suggests that prematurity is a crucial risk factor. (Table 2)

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

Table 3: Risk Factors for ROP among the study participants

Risk Factor		**ROP Present (n=71)**	**ROP Absent (n=105)**	**p value**
Type of delivery	NVD	64 (90.1%)	98 (93.3%)	0.44
	LSCS	7 (9.9%)	7 (6.7%)	
Antenatal risk factors	PIH	39 (54.9%)	56 (53.3%)	0.83
	PROM	11 (15.5%)	10 (9.5%)	0.23
	Multiple Gestation	21 (29.6%)	8 (7.6%)	<0.001
	Maternal anemia	14 (19.7%)	10 (9.5%)	0.053
	APH	4 (5.6%)	1 (0.9%)	0.17
	Previous preterm delivery	3 (4.2%)	1 (0.9%)	0.36
	Maternal infections	1 (1.4%)	1 (0.9%)	0.65
Oxygen therapy	Nil	8 (11.3%)	77 (73.3%)	<0.001
	<7 days	59 (83.1%)	24 (22.8%)	
	>7 days	4 (5.6%)	4 (3.8%)	
Neonatal events during NICU stay	Sepsis	59 (83.1%)	18 (17.1%)	<0.001
	RDS	36 (50.7%)	16 (15.2%)	<0.001
	Apnea	14 (19.7%)	5 (4.8%)	0.001
	Hyperbilirubinemia	45 (63.4%)	68 (64.7%)	0.85
	Shock	20 (28.2%)	35 (33.3%)	0.46
	Hypoglycemia	7 (9.9%)	11 (10.5%)	0.89
	Mechanical ventilation	1 (1.4%)	2 (1.9%)	0.73
	PDA	4 (5.6%)	1 (0.9%)	0.17
	Convulsions	1 (1.4%)	1 (0.9%)	0.65
	Exchange transfusion	1 (1.4%)	1 (0.9%)	0.65

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

Most deliveries were normal vaginal deliveries in both groups (90.1% in ROP vs 93.3% in non-ROP), with no significant difference (p=0.44) PIH was common in both groups (54.9% vs 53.3%, p=0.83) Multiple gestation showed a highly significant association with ROP (29.6% vs 7.6%, p<0.001) PROM (15.5% vs 9.5%) and maternal anemia (19.7% vs 9.5%) were more common in ROP group but not statistically significant. Other factors like APH (5.6% vs 0.9%), previous preterm delivery (4.2% vs 0.9%), and maternal infections (1.4% vs 0.9%) were relatively rare. Oxygen therapy emerged as a crucial factor, with 83.1% of ROP cases receiving oxygen for <7 days compared to only 22.8% in the non-ROP group (p<0.001). Neonatal complications showed significant correlations, particularly sepsis (83.1% vs 17.1%, p<0.001), RDS (50.7% vs 15.2%, p<0.001), and apnea (19.7% vs 4.8%, p=0.001).

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

Table 4: Laboratory Parameters and outcomes of study participants

Laboratory parameters		**ROP Present (n=71)**	**ROP Absent (n=105)**	**p value**
Hemoglobin		15.51±2.648	15.76±2.363	0.51
Platelet count		2.5401±1.17811	2.7423±1.21795	0.27
Leukocyte count		13335.05±5261.870	12169.36±5703.703	0.17
CRP positive		26 (36.6%)	15 (14.3%)	**<0.001**
Blood culture positive		47 (66.2%)	18 (17.1%)	**<0.001**
TC <5000		8 (11.3%)	9 (8.6%)	0.55
Treatment Outcomes	Threshold disease	4 (5.6%)	0	**0.05**
	Spontaneous Resolution	63 (88.7%)	0	**<0.001**
	Lost to follow up	2 (2.8%)	29 (27.6%)	**<0.001**

Laboratory parameters revealed significantly higher infection markers in the ROP group, with increased CRP positivity (36.6% vs 14.3%, p<0.001) and blood culture positivity (66.2% vs 17.1%, p<0.001). Treatment outcomes were generally favorable, with 88.7% of ROP cases showing spontaneous resolution and only 5.6% requiring intervention for threshold disease. Follow-up compliance was significantly better in the ROP group, with only 2.8% lost to follow-up compared to 27.6% in the non-ROP group (p<0.001). Basic laboratory parameters like

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

hemoglobin, platelet count, and leukocyte count showed no significant differences between groups.

DISCUSSION:

Retinopathy of prematurity (ROP) remains a significant preventable cause of childhood blindness, particularly in developing countries. The vulnerability of premature infants to multiple risk factors during prenatal, natal, and postnatal periods significantly influences ROP outcomes. This study analyzed 176 preterm infants (≤35 weeks gestational age or ≤2000g birth weight) to evaluate the incidence, risk factors, and outcomes of ROP in our setting. The findings were compared with various Indian and international studies to provide a comprehensive understanding of ROP epidemiology and associated risk factors. Our analysis focused on key parameters including birth weight, gestational age, antenatal risk factors, NICU events, and oxygen therapy, all of which play crucial roles in ROP development and progression.

The current study reported an ROP incidence of 40.3% among 176 screened babies, which aligns with the range found in Indian studies (20-50%) and international studies (10-45.4%). Comparable findings were reported by Sunil B et al.[13] (35.1%) in babies <32 weeks and <1500g, while Maheshwari et al[14] and Gupta et al[15] reported lower incidences of 20% and 21.7% respectively. The higher incidence in the current study may be attributed to the inclusion of babies weighing 1500-2000g, unlike other studies that typically only included babies <1500g.

Birth weight and gestational age showed significant inverse relationships with ROP development. The mean birth weight for ROP cases (1396.69±314.879g) was significantly lower than non-ROP cases (1544.69±305.428g) ($p<0.05$), with findings similar to studies by

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

Karkhaneh R et al[10] and Lad E M et al.[13] Gestational age analysis showed higher ROP incidence in lower GA groups (62.9% in <28 weeks), consistent with findings by Karkhaneh R et al[10] and Rekha S et al.[6] In terms of staging, most cases were Stage II followed by Stage I, with no advanced stages (III-V) observed.

Antenatal risk factors showed higher associations compared to studies by Chythra R et al. and Kavurt S et al,[16] including PIH (41.1%), multiple gestation (72.4%), PROM (52.3%), and maternal anemia (58.3%). NICU events like sepsis (76.6%), apnea (73.7%), and RDS (69.2%) were more frequent in the current study compared to findings by Choudhari S et al,[12] Kavurt et al,[46] and Sunil B et al.[13]

Oxygen therapy showed a significant correlation with ROP development ($p<0.05$), consistent with findings by Gupta et al.[15] ($p=0.02$) and Rekha S et al.[17] ($p<0.005$). The study notably demonstrated substantial ROP occurrence in the 1500-2000g weight group, suggesting that screening criteria should be expanded to include babies up to 2000g, particularly when additional risk factors are present.

CONCLUSION:

Our study demonstrated an ROP incidence of 40.3%, comparable with existing literature, and identified several critical risk factors associated with ROP development in a tertiary care setting. A significant inverse relationship was observed between ROP occurrence and both gestational age (≤35 weeks) and birth weight (≤2000 grams). Key antenatal risk factors included multiple gestation and maternal anemia, while significant NICU-related factors encompassed apnea, respiratory distress syndrome, and oxygen therapy. The strong association of sepsis, positive

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

blood culture, and elevated C-reactive protein with ROP development was also established. Importantly, across all birth weight and gestational age groups, babies who developed ROP consistently showed higher prevalence of these risk factors compared to those without ROP, emphasizing the multifactorial nature of ROP development and the need for comprehensive screening and monitoring protocols.

REFERENCES:

1. World Health Organization. Born Too Soon: The Global action report on preterm Birth [Internet]. Geneva: WHO; 2012 [cited 2014 Nov 23]. Available from: http://www.who.int/pmnch/media/news/2012/201204_borntoosoon-report.pdf

2. World Health Organization. Every Newborn: an action plan to end preventable deaths: Executive summary. Geneva: WHO; 2014.

3. World Health Organization. Improving neonatal & child health and development in South-East Asia. Report of meeting of South-East Asia Regional Programme Managers; 2011 Nov 15-18; Kathmandu, Nepal. WHO; 2011.

4. World Health Organization. Home visits for the newborn child- a strategy to improve survival. Geneva: WHO; 2009.

5. World Health Organization. Global Initiative for the Elimination of Avoidable Blindness: action plan 2006-2011. Geneva: WHO Press; 2007.

6. World Health Organization. Global Data on Visual Impairments 2010. Geneva: WHO; 2012.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

7. Cloherty JP, Eichenwald EC, Hansen ANR, Stark AR. Manual of Neonatal Care. 7th ed. New Delhi: Wolters Kluwer; 2012.

8. Chawla D, Agarwal R, Deorari A, Paul VK, Chandra P, Azad RV. Retinopathy of prematurity. AIIMS- NICU protocols 2010.

9. Gilbert C, Foster A. Blindness in children: control priorities and research opportunities. Br J Ophthalmol. 2001;85(9):1025-7.

10. Zin AA, Moreira MEL, Bunce C, Darlow BA, Gilbert CE. Retinopathy of Prematurity in 7 Neonatal Units in Rio de Janeiro: Screening Criteria and Workload Implications. Pediatrics. 2010;126(2):410-17.

11. World Health Organization. Universal eye health: a global action plan 2014-2019. Geneva: WHO; 2013.

12. Azad R. Retinopathy of prematurity-a giant in the developing world. Indian Pediatr. 2009;46(3):211-2.

13. Sunil B, Mathew K, Rajiv PK, Sudheer KA. Prenatal risk factors and retinopathy of prematurity among preterm infants. Int J Med Applied Sci. 2013;2(4):356-61.

14. Maheshwari R, Kumar H, Paul VK, Singh M, Deorari AK, Tiwari AK. Incidence and risk factors of retinopathy of prematurity in a tertiary care newborn unit in New Delhi. Natl Med J India. 1996;9(5):211-4.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 12, 2024

15. Gupta VP, Dhailwal U, Sharma R, Gupta P, Rohatgi J. Retinopathy of prematurity – Risk factors. Indian J Pediatr. 2004;71(10):887-92.

16. Kavurt S, Ozcan B, Aydemir O, Bas AY, Demirel N. Risk of retinopathy of prematurity in small for gestational age premature infants. Indian Pediatr. 2014;51(10):804-6.

17. Rekha S, Battu RR. Retinopathy Of Prematurity: Incidence and Risk Factors. Indian Pediatr. 1996;33(12):999-1003.