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Original Research Article

Changing Trends of Rop Screening Over 7 Years in Central India

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Abstract

Background & Methods: The aim of the study is to study Changing trends in clinical and demographic profile presentation for screening of ROP over 7 years. All included infants were screened and evaluated for ROP by a trained ophthalmologist from the Gandhi Medical College and Hamidia Hospital, with the assistance of a trained nursing staff.

Study Design: Ambispective Cohort Study.

Results: A total of 2,870 patients were included in the study over the 7-year period. Males consistently outnumbered females across all years, representing 56. 5% (1,622) of the total patients, while females accounted for 43. 5% (1,248). The largest proportion of patients (40. 1% or 1,152 patients) fell in the 1-1. 5 kg birth weight category. Mean gestational age -33 weeks the largest proportion of patients (38. 8% or 1,113 patients) fell in the 28-32 weeks gestational age category. Out of total patients over the 7 years, 74. 8% (2,148) were referred from urban areas, while 25. 2% (722) were from rural areas. Of the total 2,870 patients, 51. 6% (1,481) were inborn and 48. 4% (1,389) were outborn. The total number of cases over the seven-year period was 400.

Conclusion: Retinopathy of prematurity is one of the most common cause of preventable childhood blindness. This disease has presented with ever evolving epidemiology which has affected the diagnosis and treatment. Analyzing screening trends is important as it gives an overall impression of what all population is able to receive the ROP services at a place and to modify the screening programme as per the need of the area. In our study the largest proportion of patients (40. 1% or 1,152 patients) fell in the 1-1. 5 kg birth weight category, the largest proportion of patients (40. 1% or 1,152 patients) fell in the 1-1. 5 kg birth weight category which are the traditional high risk group. An increase in referral to tertiary centre (14% to 25.2%) denotes awareness regarding the ROP screening but lack of management services and hence to divert resources for management facility as well.

Keywords: trends, clinical, demographic & ROP.

Introduction

Retinopathy of Prematurity (ROP) has rapidly evolved from a largely unrecognized cause of childhood blindness to a major public health priority in India. Over the past two decades, the country has witnessed a striking shift in the epidemiology, risk profile, and management of ROP—driven by improvements in neonatal survival, expansion of intensive care services, and growing awareness among clinicians and policymakers.

Initially, ROP was predominantly a concern in high-income settings. As India's neonatal intensive care capacity expanded—with more preterm and low-birth-weight infants surviving—ROP emerged as a "third epidemic," characterized not only by classic risk profiles (extreme prematurity and oxygen exposure) but also by a unique burden in relatively larger and more mature preterm infants compared to Western cohorts. This reflects variability in neonatal care quality, oxygen monitoring, infection control, and nutrition practices across urban tertiary centers and peripheral units.

The screening landscape has also transformed. National and state-level programs increasingly endorse early, universal screening for at-risk preterm infants, supported by standardized guidelines that account for India-specific thresholds of gestational age and birth weight. Crucially, innovations in technology—such as wide-field digital fundus imaging and tele-ROP models—have expanded access to expert diagnosis in underserved

regions. Nurse-led and technician-assisted screening, coupled with remote grading by ophthalmologists, is improving coverage and timeliness of care. Therapeutically, the paradigm has shifted from predominantly laser photocoagulation to a more tailored approach that includes anti-VEGF agents in select cases, particularly in aggressive posterior ROP. This has brought advantages in certain clinical scenarios but also introduced new challenges around systemic safety, long-term follow-up, and recurrence monitoring. As survival improves among increasingly premature infants, the need for structured longitudinal follow-up—addressing refractive errors, strabismus, and neurodevelopmental outcomes—has become more apparent. Regional disparities remain a defining feature of India's ROP landscape. While metropolitan centers demonstrate high screening uptake and timely treatment, many district-level facilities still face gaps in equipment, training, and referral pathways. To address this, the emphasis is shifting toward integrated care models: strengthening neonatal care protocols (especially oxygen targeting and infection control), building multidisciplinary networks between neonatologists and ophthalmologists, and embedding ROP services within national child health programs

Materials and Methods

Data of all the screened neonates was abstracted from ROP clinic from the proformas filled at the time of screening. An Ambispective study was performed including all infants who received any examination(s) for ROP between 2018 and 2024. Infants who met the inclusion criteria were recruited prospectively from April 2023 to December 2024.

Clinical records of infants screened for ROP between January 2018 to December, 2024 were retrospectively reviewed. A Paediatrician identified all infants requiring screening when sent from same institute. Infants deemed to be critically unstable and at high risk for mortality underwent deferred screening until cleared by the paediatrics team. If an infant born from a multiple gestation birth required ROP screening, all NICU-supported siblings were screened.

Referred infants were screened at presentation. Disease classification and diagnosis were determined according to ICROP standards (from 2018 to 2020 ICROP 2 guidelines were followed, after that ICROP 3 guidelines were followed).

Inclusion Criteria

Data of all neonates attending the ROP clinic in Department of ophthalmology GMC Bhopal who:

- Fulfilled the Institutional screening criteria.
- Complete documentation was available.

Exclusion Criteria

- Infants with incomplete clinical records.
- All the neonates with any ocular abnormality other than ROP.

Observation and Results: A total of 2,870 patients were included in the study over the 7-year period.

Table 1: Distribution of Screened Infants With Respect To Gender

Sex	Year							Total
	2018	2019	2020	2021	2022	2023	2024	
	260	308	126	37	132	324	435	1622
Male	(57.8%)	(53.4%)	(60.9%)	(62.7%)	(61.4%)	(54.5%)	(56.7%)	(56.5%)
	190	269	81	22	83	271	332	1248
Female	(42.2%)	(46.6%)	(39.1%)	(37.3%)	(38.6%)	(45.5%)	(43.3%)	(43.5%)
	450	577	207	59	215	595	767	2870
Total	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)

A total of 2,870 patients were included in the study over the 7-year period Males consistently outnumbered females across all years, representing 56.5% (1,622) of the total patients, while females accounted for 43.5% (1,248). The male-to-female ratio remained relatively consistent across the years, with male percentage ranging from 53. 4% to 62. 7%.

Statistical analysis using Pearson Chi-Square test (value = 8.244, df = 6, p-value = 0.221) indicates that the sex distribution did not significantly differ across the years.

Table 2: Distribution of Screened Infants with Respect To Birth Weight

Birth Weight	Year							Total
	2018	2019	2020	2021	2022	2023	2024	
< 1 kg	33	41	7	7	8	31	57	184
	(7.3%)	(7.1%)	(3.4%)	(11.9%)	(3.7%)	(5.2%)	(7.4%)	(6.4%)
1-1.5 kg	206	233	93	22	71	220	307	1152
	(45.8%	(40.4%	(44.9%	(37.3%	(33.0%	(37.0%	(40.0%	(40.1%
	)	)	)	)	)	)	)	)
1.6-2 kg	134	203	71	20	83	171	210	892
	(29.8%	(35.2%	(34.3%	(33.9%	(38.6%	(28.7%	(27.4%	(31.1%
	)	)	)	)	)	)	)	)
> 2 kg	77	100	36	10	53	173	193	642
	(17.1%	(17.3%	(17.4%	(16.9%	(24.7%	(29.1%	(25.2%	(22.4%
	)	)	)	)	)	)	)	)
Total	450	577	207	59	215	595	767	2870
	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)

Pearson Chi-Square = 63.689, df = 18, P value < 0.001

The data is categorized into four birth weight groups: 2 kg. A total of 2,870 patients were included in the study over the 7-year period Mean weight for pt coming for screening – 1. 59 kg the largest proportion of patients (40. 1% or 1,152 patients) fell in the 1-1. 5 kg birth weight category the second largest group was 1. 6-2 kg (31. 1% or 892 patients), followed by >2 kg (22. 4% or 642 patients) the smallest group was less than 1 kg representing 6. 4% of total patients, which was statistically significant.(Pearson Chi-Square = 63.689, df = 18, P value < 0.001)

Table 3: Distribution of Screened Infants With Respect To Gestational Age

Gestational age (weeks)	**Year**							**Total**
	2018	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	
< 28 weeks	8	7	5	4	8	11	13	56
	(1.8%)	(1.2%)	(2.4%)	(6.8%)	(3.7%)	(1.8%)	(1.7%)	(2.0%)
28-32 weeks	150	177	67	26	95	218	380	1113
	(33.3%	(30.7%	(32.4%	(44.1%	(44.2%	(36.6%	(49.5%	(38.8%
	)	)	)	)	)	)	)	)
33-34 weeks	164	221	87	18	60	164	214	928
	(36.4%	(38.3%	(42.0%	(30.5%	(27.9%	(27.6%	(27.9%	(32.3%
	)	)	)	)	)	)	)	)
35-37 weeks	95	112	34	6	14	78	57	396
	(21.1%	(19.4%	(16.4%	(10.2%	(6.5%)	(13.1%	(7.4%)	(13.8%
	)	)	)	)	)	)	)	)
> 37 weeks	33	60	14	5	38	124	103	377
	(7.3%)	(10.4%	(6.8%)	(8.5%)	(17.7%	(20.8%	(13.4%	(13.1%
	)	)	)	)	)	)	)	)
Total	450	577	207	59	215	595	767	2870
	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)

Pearson Chi-Square = 194.442, df = 24, P value < 0.001.

The data is categorized into five gestational age groups: 37 weeks A total of 2,870 patients were included in the study over the 7-year period Mean gestational age -33 weeks The largest proportion of patients (38. 8% or 1,113 patients) fell in the 28-32 weeks gestational age category The second largest group was 33-34 weeks (32. 3% or 928 patients) The smallest group was <28 weeks, representing 2. 0%of total patient. There is a highly statistically significant difference in the distribution of gestational age categories across years (Pearson Chi-Square = 194.442, df = 24, P value < 0.001)

Table 4: Distribution of Screened Infants With Respect To Place of Referral

Place of Referral	Year							Total
	2018	2019	2020	2021	2022	2023	2024	
Urban SNCU	387 (86.0%)	484 (83.9%)	162 (78.3%)	46 (78.0%)	152 (70.7%)	424 (71.3%)	493 (64.3%)	2148 (74.8%)
Rural SNCUs	63 (14.0%)	93 (16.1%)	45 (21.7%)	13 (22.0%)	63 (29.3%)	171 (28.7%)	274 (35.7%)	722 (25.2%)
Total	450 (100%)	577 (100%)	207 (100%)	59 (100%)	215 (100%)	595 (100%)	767 (100%)	2870 (100%)

Pearson Chi-Square = 107.882 = 6, P value = < .001, Significant.

The referrals are divided into two groups: Urban and Rural. Out of a total of 2,870 patients over the 7 years, 74. 8% (2,148) were referred from urban areas, while 25. 2% (722) were from rural areas. There is statistically significant difference in referral pattern over the years (Pearson Chi-Square test shows a value of 107.882 (df = 6) with a p-value < 0.001)

Table 5: Distribution of Screened Infants With Respect To In-house SNCU and Extra Institutional SNCU

Inborn/Outborn	Year							Total
	2018	2019	2020	2021	2022	2023	2024	
Inborn	273 (60.7%)	313 (54.2%)	96 (46.4%)	22 (37.3%)	90 (41.9%)	302 (50.8%)	385 (50.2%)	1481 (51.6%)
Outborn	177 (39.3%)	264 (45.8%)	111 (53.6%)	37 (62.7%)	125 (58.1%)	293 (49.2%)	382 (49.8%)	1389 (48.4%)
Total	450 (100%)	577 (100%)	207 (100%)	59 (100%)	215 (100%)	595 (100%)	767 (100%)	2870 (100%)

Pearson Chi-Square Value: 22.93, Df: 6, P-value: 0.000822.

Patients are classified into two groups: "Inborn" (referring to infants born at the same facility where screening took place) and "Outborn" (infants born at other facilities and referred for screening). Of the total 2,870 patients, 51. 6% (1,481) were inborn and 48. 4% (1,389) were outborn. There is a statistically significant difference in the distribution of inborn versus outborn patients across the years. (The Pearson Chi-Square test (value = 32.471, df = 6, p < 0.001)

Table 6: Distribution of Screened Infants With Respect To Modes of Screening

Mode of Screening	Year							Total
	2018	2019	2020	2021	2022	2023	2024	
Binocular Indirect Ophthalmoscope	434 (96.4%)	566 (98.1%)	201 (97.1%)	49 (83.1%)	183 (85.1%)	571 (96.0%)	710 (92.6 %)	2714 (94.6%)
RET CAM	3 (0.7%)	3 (0.5%)	0 (0.0%)	0 (0.0%)	2 (0.9%)	0 (0.0%)	3 (0.4%)	11 (0.4%)
Both	13 (2.9%)	8 (1.4%)	6 (2.9%)	10(16.9 %)	30 (14.0%)	24 (4.0%)	54 (7.0%)	145 (5.1%)
Total	450 (100%)	577 (100%)	207 (100%)	59 (100%)	215 (100%)	595 (100%)	767 (100%)	2870 (100%)

Pearson Chi-Square = 89.461, df = 12, P value = .001, Significant.

The vast majority of screenings were performed using the binocular indirect ophthalmoscope (94. 6%). A small segment (5. 1% overall) was screened using both modalities. There is a statistically significant difference in the mode of screening proportions across the years. (Pearson Chi-Square test value = 89.461 with 12 degrees of freedom, p = 0.001)

Table 7: Distribution of Diagnosed Rop over the Years

Number of Infants	Year							Total
	2018	2019	2020	2021	2022	2023	2024	
Total number screened	450	577	207	59	215	595	767	2870
Total number diagnosed	67 (16.8%)	61 (15.3%)	15 (3.8%)	19 (4.8%)	50 (12.5%)	74 (18.5%)	114 (28.5%)	400 (16.8%)

Pearson chi square = 120.94, df = 6, P value = < 0.00000001, significant

The total number of cases over the seven-year period was 400. Highest number of patient diagnosed with ROP was seen in 2024. The second highest number was seen in 2023. Least number of patient were diagnosed in year 2020. There is a statistically significant difference in the distribution

of patients diagnosed with ROP across the years (Pearson chi square = 120.94, df = 6, P value = < 0.00000001)

Discussion

Our study demonstrates a clear upward trend in the overall number of patients presenting for retinopathy of prematurity (ROP) evaluation over the study period which is 450 infants in 2018 which increased up to 767 infants in 2024. This increase likely reflects a combination of improved neonatal survival, enhanced awareness among healthcare providers, expanded screening coverage, and possibly the implementation of innovative approaches to ROP care. The male-to-female ratio remained relatively consistent across the years. This finding supports our observation that sex distribution remains relatively constant even as other demographic parameters of the ROP population may shift over time. The stability in sex distribution observed in our study, despite increasing overall patient numbers, suggests that improvements in neonatal care and changes in referral patterns have affected male and female infants relatively equally. This finding is important as it indicates that screening protocols need not be sex-specific, and resources for ROP management can be allocated without consideration of potential shifts in gender distribution.

The largest proportion of patients (40.1% or 1,152 patients) fell in the 1-1.5 kg birth weight category.)The proportion of babies with birth weight >2 kg increased substantially in recent years (from 17.1% in 2018 to 25.2% in 2024, with a peak of 29.1% in 2023) .No study have been conducted on the weight profile of patients coming for ROP screening but may studies have suggested that there is a rise seen in heavier babies. Increase representation of heavier babies in our screening clinic shows that we performing adequate screening covering both ends of the spectrum. These findings highlight the need for revised screening guidelines that consider not only traditional birth weight and gestational age criteria but also additional risk factors that may predispose larger infants to ROP.

There is a significant shift in referral patterns over time, with an increasing proportion of patients coming from rural areas, which may reflect improved outreach and enhanced awareness or accessibility of ROP screening in rural regions. The rising number of patients from rural areas in our study demonstrates a positive shift toward more comprehensive screening and referral practices. This trend is well in line with the published literature, emphasizing that targeted rural outreach, improved healthcare delivery.

In our study, we found that there was increase in number of babies who were not born in our institute which was 177 in 2018 and 382 in 2024. It was initially 1/3 of the babies coming for screening now it is ½ of the babies coming for screening. This trend likely reflects a combination of factors, including improved awareness among referring physicians, enhanced referral networks, successful implementation of hub-and-spoke models for ROP screening, and our institution's growing reputation as a center for ROP management.

The binocular indirect ophthalmoscope continues to be the cornerstone of ROP screening in our study, the statistically significant shift toward combined modality screening reflects an adaptive, technology-enriched approach.

There is an increasing trend in Incidence of ROP in this study 16.8%in 2018 to 28.5% in 2024 which is concordant with the patterns documented. This could be attributed to enhanced detection methods, broadening of the at-risk population and advancing neonatal care practices which have led to higher survival rates of premature infants consequently increasing the pool of infants susceptible to ROP. Additionally factors such as improved awareness among referring physicians, enhanced referral networks, successful implementation of hub-and-spoke models for ROP screening, and our institution's growing reputation as a center for ROP management.

Limitations

This analysis relied on an ambispective design and available clinical records; missing data and changes in screening protocols over time may introduce bias.

Conclusion

Over seven years, ROP screening volume and management patterns evolved, with improved detection and changing treatment preferences. Strengthening early screening, standardizing follow-up, and addressing regional access gaps can further reduce vision-threatening ROP and improve long-term outcomes.

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