Open Access

ISSN: 2617-0817 E-ISSN: 2789-5912

Original Article

Incidence of Plus Disease and Aggressive Posterior ROP in Single and Multiple Birth Neonates

DOI: dx.doi.org

Tanjima Yeasmin Liza[1*], Faria Tilat Tima[2], Abhishek Debnath[3], Tanshed Arafat[4], Trishna Rani Sen[5]

Received: 24 Jan 2024
Accepted: 26 Jan 2024
Published: 28 Feb 2024

Published by:
Sher-E-Bangla Medical College, Barishal, Bangladesh

*Corresponding Author

ABSTRACT

Background: *Retinopathy of Prematurity (ROP) is a growing cause of childhood blindness in countries like Bangladesh due to high preterm birth rates. However, data comparing the incidence of Plus Disease and AP-ROP in single vs. multiple-birth neonates remain limited.* ***Methods & Materials:*** *A cross-sectional analytical study was conducted at the Department of Ophthalmology, Dhaka Medical College Hospital, from January to December 2023. A total of 82 preterm neonates (age ≥30 days, gestational age ≤35 weeks, birth weight ≤2000g) were included via consecutive sampling and divided into two groups: single-birth (n=41) and multiple-birth neonates (twins or more; n=41). Demographic data, ROP staging, zone involvement, Plus Disease, and AP-ROP presence were evaluated using indirect ophthalmoscopy and RetCam imaging. Statistical analyses were performed using SPSS version 23.* ***Results:*** *Zone II ROP was significantly more prevalent among multiple-birth neonates compared to single-birth neonates (65.9% vs. 31.7%, p=0.002). Conversely, Zone III ROP was significantly more common in single-birth neonates (58.5% vs. 29.3%, p=0.008). Plus Disease (48.8% vs. 39.0%, p=0.373) and AP-ROP (4.9% vs. 9.8%, p=0.396) were more frequent in multiple-birth neonates, but differences were not statistically significant. No significant demographic differences were found between groups in terms of age, gestational age, birth weight, or gender.* ***Conclusion:*** *Multiple-birth neonates exhibit significantly higher Zone II ROP, while singletons have higher Zone III involvement. Though Plus Disease and AP-ROP were more common among multiple-birth neonates, these findings lacked statistical significance. These results emphasize the importance of tailored ROP screening protocols based on birth plurality in Bangladesh.*

Keywords: *Retinopathy of Prematurity, Plus Disease, AP-ROP, Single-Birth Neonates, Multiple-Birth Neonates*

(The Planet 2024; 8(1): 249-253)

1. *Assistant Registrar, Department of Ophthalmology, Cumilla Medical College, Cumilla, Bangladesh*
2. *Junior Consultant, Department of Ophthalmology, Dhaka Medical College, Dhaka, Bangladesh*
3. *Medical Officer, Cumilla Medical College, Cumilla, Bangladesh*
4. *Classified Specialist, Department of Radiology and Imaging, Combined Military Hospital, Cumilla, Bangladesh*
5. *Medical Officer, Department of Ophthalmology, Rangppur Medical College, Rangpur, Bangladesh*

INTRODUCTION

Retinopathy of Prematurity (ROP) remains one of the leading causes of preventable childhood blindness worldwide, primarily affecting preterm neonates who receive neonatal intensive care [1]. Advances in neonatal care have significantly increased the survival rates of preterm and very low birth weight (VLBW) infants; however, this progress has also led to a higher incidence of ROP, particularly in low- and middle-income countries [2]. Globally, 31.9% of preterm infants are estimated to develop ROP, with severe cases requiring urgent intervention to prevent vision loss [3]. Among these, Plus Disease, characterized by venous dilation and arterial tortuosity in the posterior retina, serves as a critical indicator of severe ROP progression [4]. Additionally, Aggressive Posterior ROP (AP-ROP) is a rapidly progressing subtype that often requires immediate laser photocoagulation or anti-VEGF therapy to prevent retinal detachment and blindness [5]. In Bangladesh, the burden of ROP is growing due to the country's high preterm birth rate. With approximately 3.75 million newborns annually, nearly 25,000 are born with a birth weight below 1,500 grams, placing them at substantial risk of developing ROP [6]. A recent tertiary hospital-based study in Bangladesh reported an ROP prevalence of 31.9%, which aligns with global trends but is exacerbated by insufficient neonatal oxygen regulation, delayed screenings, and lack of follow-up care [7]. Furthermore, the absence of national ROP screening protocols contributes to delayed diagnoses, increasing the risk of severe, irreversible visual impairment [8]. Studies suggest that inadequate screening and delayed treatment contribute to severe ROP cases in more than 78% of affected neonates, emphasizing the urgent need for structured national guidelines [9]. Multiple well-established risk factors contribute to ROP development, including low gestational age, low birth weight, prolonged oxygen therapy, sepsis,

ISSN: 2617-0817 E-ISSN: 2789-5912

mechanical ventilation, and multiple blood transfusions [10]. Among these, gestational age <32 weeks and birth weight <1,500g are the strongest predictors of severe ROP [11]. Additionally, bronchopulmonary dysplasia, respiratory distress syndrome, and neonatal infections further exacerbate disease progression [12]. However, multiple gestation (twins, triplets, and quadruplets) has emerged as a potential but under-researched risk factor. Multiple-birth pregnancies are strongly associated with preterm delivery and low birth weight, which indirectly elevates the risk of ROP [13]. Some studies have reported no significant difference in ROP incidence between single and multiple-birth neonates, whereas others have observed a higher prevalence of ROP among triplets and quadruplets [14]. A retrospective study from a large neonatal cohort demonstrated that triplets had an ROP prevalence of 33.3%, significantly higher than twins (8.79%) [15]. However, the lack of robust comparative data makes it difficult to determine whether multiple gestations independently increases ROP risk or if the association is primarily due to lower gestational age and birth weight. Despite extensive research on general ROP risk factors, the role of multiple gestation in severe ROP subtypes, specifically Plus Disease and AP-ROP, remains poorly understood. Existing studies do not differentiate the risk and progression of these severe forms between single-birth and multiple-birth neonates [16]. While some studies show that low birth weight and oxygen therapy duration—not multiple gestation in general—are the key risk factors for Plus Disease, other research imply that twins and triplets may have a greater risk of severe ROP due to increased neonatal instability and longer NICU stays [17]. However, there is no conclusive evidence on whether multiple-birth neonates are at greater risk of AP-ROP compared to singletons. This knowledge gap hinders clinicians' ability to develop targeted screening protocols, potentially leading to delayed or inadequate screening in high-risk neonates. Given the limited neonatal resources in Bangladesh, efficient screening and treatment prioritization are essential. Understanding whether single or multiple-birth neonates exhibit different risks for Plus Disease and AP-ROP could aid in developing targeted national screening guidelines, optimizing resource allocation, and improving early intervention strategies [6]. Moreover, identifying whether multiple-birth neonates require more frequent screenings could contribute to reducing severe ROP cases and improving long-term visual outcomes [8]. Despite the high ROP prevalence in Bangladesh, there is a lack of robust comparative studies evaluating the incidence and severity of Plus Disease and AP-ROP between singletons and multiples. This study aims to address this critical knowledge gap by conducting a comparative analysis of Plus Disease and AP-ROP between single and multiple-birth preterm neonates in Bangladesh. By establishing whether multiple gestations are an independent risk factor for severe ROP subtypes, this research could contribute to evidence-based neonatal ophthalmologic screening programs. Ultimately, the findings will help improve ROP detection strategies, inform national public health policies, and enhance clinical decision-making for high-risk neonates.

METHODS & MATERIALS

This cross-sectional analytical study was conducted at the Department of Ophthalmology, Dhaka Medical College Hospital, Dhaka, from January 2023 to December 2023, spanning 12 months. The study population included inborn preterm neonates admitted to the hospital. A total of 82 neonates meeting the inclusion criteria were enrolled using consecutive sampling. Inclusion criteria consisted of neonates aged ≥30 days with a history of preterm birth (gestational age ≤35 weeks) and low birth weight (≤2000 grams), categorized into Group A (single-birth neonates) and Group B (multiple-birth neonates, including twins, triplets, and quadruplets). Neonates with full-term birth (gestational age >35 weeks) or those who were severely ill were excluded. Ethical approval was obtained from the Ethical Review Committee (ERC) of Dhaka Medical College, Dhaka (Memo No. ERC-DMC/ECC/2022/438; Date: 12/12/2022), and informed written consent was collected from the legal guardians of all participants. Data collection involved history taking, physical examination, and recording baseline demographic and clinical variables (age, gender, gestational age, and birth weight) using a structured questionnaire. Birth weight was measured using a digital baby scale; ensuring neonates were without shoes or heavy clothing. Fundoscopic examination was performed after pupil dilation with tropicamide (0.5%) and phenylephrine (2.5%) drops, administered 60 minutes prior to the examination at 20-minute intervals. Topical anesthetic was applied before indirect ophthalmoscopy with a 28D condensing lens and RetCam Shuttle to assess the presence and severity of ROP, Plus Disease (arterial tortuosity and venous dilation), and Aggressive Posterior ROP (AP-ROP). ROP staging followed the standard five-stage classification, with zone determination based on proximity to the optic nerve. All collected data were stored securely in a separate data record form. Statistical analysis was conducted using SPSS version 23 (IBM Corp, Armonk, NY). Categorical variables were summarized as frequencies and percentages, while continuous variables were described using means, medians, standard deviations, and percentiles. Student's t-test was applied for continuous data, whereas Chi-Square and Fisher's Exact tests were used for categorical data. A p-value <0.05 was considered statistically significant. Ethical considerations included ensuring patient privacy, data confidentiality, and voluntary participation, with participants given the right to withdraw at any time without consequences. No financial incentives were provided for participation.

ISSN: 2617-0817 E-ISSN: 2789-5912

RESULTS

Table – I: Demographic profile of the study subjects (*n*=82)

Variable	Single	Multiple	p-value
Age (Days)	31.70 ± 1.21	31.35 ± 1.26	[a]0.379
Weight (gm)			
1000 - <1500	12 (29.3)	15 (36.6)	[b]0.639
1500 - <2500	29 (70.7)	26 (63.4)	
Mean±SD	1532 ± 276	1482 ± 262	[b]0.403
Gestational age (weeks)			
≤33	30 (73.2)	28 (68.3)	[b]0.627
>33	11 (26.8)	13 (31.7)	
Mean±SD	32.12 ± 1.65	32.53 ± 1.48	[a]0.363
Gender			
Male	22 (53.7)	28 (68.3)	[b]0.174
Female	19 (46.3)	13 (31.7)	

[a]Unpaired t test and [b]Chi-Square test was done

The demographic characteristics of the study participants are summarized in Table I. The mean age of neonates in the single-birth group was 31.70 ± 1.21 days, while in the multiple-birth group, it was 31.35 ± 1.26 days, with no statistically significant difference (p = 0.379). Regarding birth weight, 29.3% of single-birth neonates weighed between 1000–1500 grams, compared to 36.6% of multiple-birth neonates, while the remaining majority in both groups had a birth weight between 1500–2500 grams. The mean birth weight was 1532 ± 276 grams in singletons and 1482 ± 262 grams in multiples, showing no significant difference (p = 0.403). Similarly, gestational age distribution was comparable between the groups, with 73.2% of single-birth neonates and 68.3% of multiple-birth neonates born at ≤33 weeks of gestation. The mean gestational age was 32.12 ± 1.65 weeks in the single-birth group and 32.53 ± 1.48 weeks in the multiple-birth group, with no significant difference (p = 0.363). In terms of gender distribution, the male-to-female ratio was higher in multiple-birth neonates (68.3% males vs. 31.7% females) compared to singletons (53.7% males vs. 46.3% females), although this difference was not statistically significant (p = 0.174). Overall, no significant demographic differences were observed between the two groups.

Table – II: Stages of ROP of the single and multiple birth neonates (*n*=82)

Stages	Single *n*(%)	Multiple *n*(%)	p-value
Stage-1	21 (51.2)	15 (36.6)	[a]0.182
Stage-2	18 (43.9)	26 (63.4)	[a]0.076
Stage-3	2 (4.9)	0 (0.0)	[b]0.494

[a]Chi-Square test and [b]Fisher's Exact test was done.

The distribution of ROP stages among single and multiple-birth neonates is presented in Table II. Stage 1 ROP was observed in 51.2% of single-birth neonates and 36.6% of multiple-birth neonates, with no statistically significant difference (p = 0.182). Conversely, Stage 2 ROP was more frequent among multiple-birth neonates (63.4%) compared to single-birth neonates (43.9%), but this difference did not reach statistical significance (p = 0.076). Stage 3 ROP, the most severe stage identified in this study, was observed in 4.9% of single-birth neonates, whereas none of the multiple-birth neonates developed Stage 3 disease (p = 0.494).

Table – III: Zone where ROP found in single and multiple birth neonates (*n*=82)

Zones	Single *n*(%)	Multiple *n*(%)	p-value
Zone-I	4 (9.8)	2 (4.9)	[b]0.675
Zone-II	13 (31.7)	27 (65.9)	[a]0.002
Zone-III	24 (58.5)	12(29.3)	[a]0.008

[a]Chi-Square test and [b]Fisher's Exact test was done.

The distribution of ROP zones among single and multiple-birth neonates is summarized in Table III. Zone I ROP, the most posterior and severe form, was found in 9.8% of single-birth neonates and 4.9% of multiple-birth neonates, with no statistically significant difference (p = 0.675). Zone II ROP was significantly more common among multiple-birth neonates (65.9%) compared to single-birth neonates (31.7%), showing a statistically significant difference (p = 0.002). Conversely, Zone III ROP, which typically carries a better prognosis, was significantly more prevalent among single-birth neonates (58.5%) than in multiple-birth neonates (29.3%), also reaching statistical significance (p = 0.008).

Table – IV: Presence of plus disease and Aggressive posterior ROP (AP-ROP) in single and multiple birth neonates (*n*=82)

Variable	Single *n*(%)	Multiple *n*(%)	p-value
Presence of plus disease			
Yes	16 (39.0)	20 (48.8)	0.373
No	25 (61.0)	21 (51.2)	
Presence of AP-ROP			
Yes	4 (9.8)	2 (4.9)	0.396
No	37 (90.2)	39 (95.1)	

The presence of Plus Disease and Aggressive Posterior ROP (AP-ROP) among single and multiple-birth neonates is presented in Table IV. Plus Disease, a marker of severe ROP, was observed in 39.0% of single-birth neonates and 48.8% of multiple-birth neonates, though this difference was not statistically significant (p = 0.373). Similarly, AP-ROP, the most aggressive form of ROP, was identified in 9.8% of single-birth neonates and 4.9% of multiple-birth neonates, but the

ISSN: 2617-0817 E-ISSN: 2789-5912

difference was also not statistically significant (p = 0.396). These findings suggest that while multiple-birth neonates had a slightly higher prevalence of Plus Disease, and single-birth neonates had a higher occurrence of AP-ROP, neither variable showed a statistically significant difference between the groups.

DISCUSSION

Retinopathy of Prematurity (ROP) remains a significant cause of preventable childhood blindness worldwide, with its burden increasingly recognized in developing countries like Bangladesh, where the prevalence of preterm births remains high. This study analyzed the incidence of Plus Disease and Aggressive Posterior ROP (AP-ROP) in single and multiple-birth neonates, highlighting both statistically significant and non-significant findings that provide critical insights into neonatal care and screening strategies. A key statistically significant finding in this study was the higher prevalence of Zone II ROP in multiple-birth neonates (65.9%) compared to single-birth neonates (31.7%) (p = 0.002). This aligns with previous research showing that Zone II is the most commonly affected area in multiple-birth neonates, likely due to their increased prematurity and associated vascular immaturity [18]. These findings emphasize the need for intensified screening in multiple-birth neonates, as Zone II ROP has been associated with greater disease progression risks. Conversely, Zone III ROP was significantly more common in single-birth neonates (58.5%) than in multiple-birth neonates (29.3%) (p = 0.008). This result is consistent with prior studies indicating that Zone III ROP is typically associated with milder disease and lower risk of progression to advanced stages [19]. Additionally, previous research suggests that singletons may have a higher proportion of Zone III involvement, potentially reflecting differences in postnatal care and oxygen therapy exposure [20]. These findings suggest that, while multiple-birth neonates require aggressive early screening due to higher Zone II involvement, singletons with Zone III ROP should still be monitored closely, given the possibility of later-stage progression in some cases. Regarding Plus Disease and AP-ROP, both were more frequent in multiple-birth neonates (48.8% and 4.9%, respectively) compared to single-birth neonates (39.0% and 9.8%), though these differences were not statistically significant (p = 0.373, p = 0.396). Similar trends have been reported in prior studies, where Plus Disease was found to be more common in neonates requiring prolonged mechanical ventilation and oxygen support rather than being directly linked to multiple gestation [4]. Likewise, a retrospective study on 497 preterm neonates confirmed that gestational age, low birth weight, and oxygen therapy duration were stronger predictors of Plus Disease than birth type [21]. Additionally, AP-ROP, while more frequently observed in singletons in our study, has been found to primarily affect neonates with extreme prematurity (<25 weeks) and birth weights <750g rather than being significantly associated with singleton or multiple gestation status [22]. These findings reinforce the idea that while multiple-birth neonates exhibit a slightly higher prevalence of Plus Disease and AP-ROP, gestational and postnatal factors remain the predominant risk determinants. When evaluating ROP staging, Stage 1 ROP was more common in single-birth neonates (51.2%) than in multiple-birth neonates (36.6%), while Stage 2 ROP was more frequent in multiple-birth neonates (63.4%) compared to single-birth neonates (43.9%). Although these differences did not reach statistical significance, the trends align with past studies indicating that Stage 2 ROP has a slightly higher prevalence in multiple-birth neonates, though it often regresses spontaneously without intervention [23]. Furthermore, Stage 3 ROP was observed only in single-birth neonates (4.9%), which is consistent with reports suggesting that singletons may exhibit a slightly higher frequency of severe ROP, potentially due to differential oxygen administration and neonatal stabilization protocols [23]. However, like our study, previous research has found that these differences are often not statistically significant, emphasizing that prematurity and postnatal care remain stronger determinants of ROP severity than birth plurality alone. Clinically, these findings hold important implications for ROP screening and management protocols. The higher prevalence of Zone II ROP in multiple-birth neonates and Zone III ROP in singletons suggests that targeted screening strategies should be developed. Specifically, multiple-birth neonates should undergo frequent early screening for Zone II involvement and possible Plus Disease, while singletons with Zone III ROP should still be monitored carefully for potential later-stage progression. Additionally, given that Plus Disease and AP-ROP were more frequent in multiple-birth neonates, despite not reaching statistical significance, the clinical importance of close observation cannot be understated.

Limitations of The Study

A key limitation of this study is its small sample size (N=82), which may limit statistical power. Nonetheless, the findings align with existing literature. Larger, multicenter studies in Bangladesh are needed to confirm these results.

CONCLUSION

In conclusion, this study provides important comparative insights into ROP characteristics among single and multiple-birth neonates, aligning with prior research in many aspects. The significant findings regarding Zone II and Zone III ROP distributions emphasize the need for tailored screening strategies, while the non-significant but clinically important trends in Plus Disease, AP-ROP, and ROP staging highlight the continued importance of vigilant neonatal monitoring. These results contribute valuable data to the growing literature on ROP epidemiology in developing countries and may aid in refining ROP screening and intervention guidelines in Bangladesh and similar settings.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

ISSN: 2617-0817 E-ISSN: 2789-5912

REFERENCES

1. *Blencowe H, Lawn JE, Vazquez T, Fielder A, Gilbert C. Preterm-associated visual impairment and estimates of retinopathy of prematurity at regional and global levels for 2010. Pediatr Res. 2013 Dec;74 Suppl 1(Suppl 1):35–49.*
2. *García H, Villasis-Keever MA, Zavala-Vargas G, Bravo-Ortiz JC, Pérez-Méndez A, Escamilla-Núñez A. Global Prevalence and Severity of Retinopathy of Prematurity over the Last Four Decades (1985-2021): A Systematic Review and Meta-Analysis. Arch Med Res. 2024 Feb;55(2):102967.*
3. *Nair A, El Ballushi R, Anklesaria BZ, Kamali M, Talat M, Watts T. A Review on the Incidence and Related Risk Factors of Retinopathy of Prematurity Across Various Countries. Cureus. 2022 Nov;14(11):e32007.*
4. *Bellsmith KN, Brown J, Kim SJ, Goldstein IH, Coyner A, Ostmo S, et al. Aggressive Posterior Retinopathy of Prematurity: Clinical and Quantitative Imaging Features in a Large North American Cohort. Ophthalmology. 2020 Aug;127(8):1105–12.*
5. *Drenser KA, Trese MT, Capone A. Aggressive posterior retinopathy of prematurity. Retina. 2010 Apr;30(4 Suppl):S37-40.*
6. *Rahman DM, Nag DDK, Hoque MM, Saha DLC. Retinopathy of Prematurity –Recent Screening Status in a Tertiary Care Hospital of Bangladesh: Pharmaceutical Science-Pediatrics for Better Child Health. International Journal of Life Science and Pharma Research [Internet]. 2020 [cited 2025 Mar 24];31–6. Available from: https://ijlpr.com/index.php/journal/article/view/652*
7. *Ahmed ASMNU, Muslima H, Anwar KS, Khan NZ, Chowdhury MAKA, Saha SK, et al. Retinopathy of prematurity in Bangladeshi neonates. J Trop Pediatr. 2008 Oct;54(5):333–9.*
8. *Akter S, Hossain MM, Shirin M, Anwar KS. Retinopathy of Prematurity - Neonatologists' Experience. Journal of Bangladesh College of Physicians and Surgeons [Internet]. 2013 [cited 2025 Mar 24];31(4):181–8. Available from: https://www.banglajol.info/index.php/JBCPS/article/view/21001*
9. *Bhuiyan ANH, Mannan MA, Dey SK, Choudhury N, Shameem M, Shahidullah M. Frequency and Risk Factors for Retinopathy of Prematurity in Very Low Birth Weight Infants in NICU, BSMMU. TAJ: Journal of Teachers Association [Internet]. 2019 Aug 22 [cited 2025 Mar 24];32(1):54–61. Available from: https://www.banglajol.info/index.php/TAJ/article/view/42736*
10. *Mannan MA. Frequency and risk factors of retinopathy of prematurity among preterm neonates in a tertiary care hospital of Bangladesh. J Clin Pediatr Neonatol [Internet]. 2023 Nov 29 [cited 2025 Mar 24];Volume 3(Issue 1):11–7. Available from: https://www.probiologists.com/article/frequency-and-risk-factors-of-retinopathy-of-prematurity-among-preterm-neonates-in-a-tertiary-care-hospital-of-bangladesh*
11. *Kumar KL, Seeralar ATA, Kamalarathnam CN. Retinopathy of prematurity in a tertiary care center: A study of prevalence, risk factors, and outcomes. Indian Journal of Child Health [Internet]. 2017 Sep 26 [cited 2025 Mar 24];4(3):390–3. Available from: https://mansapublishers.com/index.php/ijch/article/view/39*
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.*
13. *Kim SJ, Port AD, Swan R, Campbell JP, Chan RVP, Chiang MF. Retinopathy of Prematurity: A Review of Risk Factors and their Clinical Significance. Surv Ophthalmol [Internet]. 2018 [cited 2025 Mar 24];63(5):618–37. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6089661/*
14. *Friling R, Axer-Siegel R, Hersocovici Z, Weinberger D, Sirota L, Snir M. Retinopathy of prematurity in assisted versus natural conception and singleton versus multiple births. Ophthalmology. 2007 Feb;114(2):321–4.*
15. *Neamah GT, Al Nwuaini MQ, Abd KA, Nasrawi AJM, Hussein SRM. Retinopathy of prematurity, a two-year experience at the ROP screening unit from AL-Zahraa Teaching Hospital, AL-Najaf, Iraq. Journal of Medicine and Life [Internet]. 2022 [cited 2025 Mar 24];15(11):1431. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC9762363/*
16. *Afarid M, Hosseini H, Abtahi B. Screening for retinopathy of prematurity in South of Iran. Middle East Afr J Ophthalmol. 2012;19(3):277–81.*
17. *Gaber R, Sorour OA, Sharaf AF, Saad HA. Incidence and Risk Factors for Retinopathy of Prematurity (ROP) in Biggest Neonatal Intensive Care Unit in Itay Elbaroud City, Behera Province, Egypt. OPTH [Internet]. 2021 Aug [cited 2025 Mar 24];Volume 15:3467–71. Available from: https://www.dovepress.com/incidence-and-risk-factors-for-retinopathy-of-prematurity-rop-in-bigge-peer-reviewed-fulltext-article-OPTH*
18. *García-Serrano JL, Ramírez-García MC, Piñar-Molina R. [Retinopathy of prematurity in multiple births: risk analysis for plus disease]. Arch Soc Esp Oftalmol. 2009 Apr;84(4):191–8.*
19. *Agarwal K, Jalali S. Classification of retinopathy of prematurity: from then till now. Community Eye Health [Internet]. 2018 [cited 2025 Mar 24];31(101):S4–7. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6157799/*
20. *Jalali S, Kesarwani S, Hussain A. Outcomes of a protocol-based management for zone 1 retinopathy of prematurity: the Indian Twin Cities ROP Screening Program report number 2. Am J Ophthalmol. 2011 Apr;151(4):719-724.e2.*
21. *Tsui I, Ebani E, Rosenberg JB, Angert RM, Lin J, Mian U. Trends in Retinopathy of Prematurity Over a 5-Year Period in a Racially Diverse Population. Ophthalmic Surgery, Lasers and Imaging Retina [Internet]. 2014 Mar [cited 2025 Mar 24];45(2):138–42. Available from: https://journals.healio.com/doi/10.3928/23258160-20140306-07*
22. *Ren J, Yuan Y, Chi X, Luo X, Nie C. Comparative study on the incidence of retinopathy of prematurity in premature infants born in the hospital and transported from other hospitals. Chinese Journal of Applied Clinical Pediatrics [Internet]. 2020 [cited 2025 Mar 24];293–6. Available from: http://dx.doi.org/10.3760/cma.j.cn101070-20190704-00596*
23. *Ju RH, Zhang JQ, Ke XY, Lu XH, Liang LF, Wang WJ. Spontaneous regression of retinopathy of prematurity: incidence and predictive factors. Int J Ophthalmol [Internet]. 2013 Aug 18 [cited 2025 Mar 24];6(4):475–80. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3755307/*