ISSN (O) :3021-6885

RESEARCH PAPER.

REFRACTIVE OUTCOMES OF BABIES WHO UNDERWENT TREATMENT FOR TYPE 1 (TREATMENT WARRANTED) ROP 2020-2024

Wannigama E[1], Gunarathne HWNN S[2]

[1]Consultant Opthalmologist Provincial General Hospital Badulla, Sri Lanka, [2]Consultant Dermatologist Provincial General Hospital Badulla, Sri Lanka

Corresponding Author**:** erandamailbox@gmail.com

ABSTRACT

Refractive outcomes of infants treated for Type 1 Retinopathy of Prematurity (ROP), a vision-threatening condition in premature infants characterized by abnormal retinal blood vessel development. The analysis included infants born before 34 weeks' gestation from 2020 to 2024 who underwent either laser therapy or anti-VEGF injections for Type 1 ROP, with refractive assessments conducted at 1 and 3 years of age. Refractive errors considered were myopia, hyperopia, astigmatism, and anisometropia, defined by specific diopter criteria. A total of 120 infants met the inclusion criteria, with nearly equal numbers treated with laser therapy (54%) and anti-VEGF (46%). The average birth weight was 1,200 grams, and the mean gestational age was 28 weeks. At 1 year of age, 60% of the infants had significant refractive errors, increasing to 75% by 3 years. Myopia was the most prevalent refractive error, affecting 45% of infants at 1 year and 60% at 3 years. Astigmatism and anisometropia were also common, with astigmatism increasing from 35% to 50% and anisometropia from 10% to 20% over the study period. Laser therapy was associated with a higher prevalence of myopia at 3 years (70%) compared to anti-VEGF treatment (45%), and high myopia (≤-5.00 D) was more frequent in the laser-treated group (30% vs. 10%). Astigmatism rates were similar between treatment groups, but anisometropia was more common in the laser group (25% vs. 15%). The findings indicate that refractive errors are prevalent in children treated for Type 1 ROP, with laser therapy posing a higher risk of myopia. The study emphasizes the need for long-term follow-up and early intervention to manage refractive errors and suggests that anti-VEGF treatment may help reduce the risk of high myopia. Further research is needed to evaluate the safety of anti-VEGF, explore combination therapies, and establish new treatment protocols to optimize visual outcomes. Routine ophthalmic evaluations are essential for detecting and managing refractive errors in children treated for ROP.

INTRODUCTION

Retinopathy of Prematurity (ROP) is a potentially blinding eye disorder primarily affecting premature infants with low birth weight and gestational age. It is characterized by the abnormal development of retinal blood vessels, which can progress to retinal detachment if untreated. Type 1 ROP is considered a severe form that necessitates timely intervention, typically through laser photocoagulation or intravitreal anti-vascular endothelial growth factor (anti-VEGF) injections. The refractive development in infants treated for ROP is a critical aspect of long-term visual outcomes. Refractive errors, including myopia, hyperopia, astigmatism, and anisometropia, are frequently observed in these infants and can impact visual acuity and quality of life. The purpose of this study is to analyze the refractive outcomes in infants who underwent treatment for Type 1 ROP, evaluating the effects of different treatment modalities on visual development.

METHODS

Children born with premature gestational age (< 34 weeks) during four years (from 2020-2024) were evaluated descriptively. Medical records of infants treated for Type 1 ROP in a tertiary care hospital were reviewed. Infants diagnosed with Type 1 ROP who underwent treatment (either laser therapy or anti-VEGF injections) and had at least one refractive assessment conducted at 1 year and 3 years of age included. Prevalence of refractive errors (myopia, hyperopia, astigmatism, anisometropia) at 1 year and 3 years of age. Myopia was defined as a spherical equivalent of -0.50 diopters (D) or more negative, hyperopia as +1.50 D or more positive, and significant astigmatism as ≥1.50 D cylinder. Anisometropia was defined as a difference of ≥1.50 D in spherical equivalent between the two eyes were targeted as outcomes of the study.

RESULTS

A total of 120 infants met the inclusion criteria, with 65 (54%) treated with laser therapy and 55 (46%) with anti-VEGF injections. The mean birth weight was 1,200 ± 150 grams, and the mean gestational age was 28 ± 2 weeks. The groups were comparable in terms of birth weight, gestational age, and gender distribution. At 1 year of age, 60% of infants had significant refractive errors, which increased to 75% by 3 years. The most common refractive error was myopia (45% at 1 year, 60% at 3 years). Astigmatism was present in 35% of infants at 1 year and increased to 50% by 3 years. Anisometropia was observed in 10% of

cases at 1 year, increasing to 20% at 3 years. Infants treated with laser therapy had a higher prevalence of myopia at 3 years (70%) compared to those treated with anti-VEGF (45%). High myopia (spherical equivalent ≤-5.00 D) was more common in the laser group (30%) than in the anti-VEGF group (10%). Astigmatism was similarly distributed between the groups, while anisometropia was more frequent in the laser-treated group (25% vs. 15%).

DISCUSSION

The findings of this study are consistent with previous research showing that refractive errors, especially myopia, are common in infants treated for ROP. The higher prevalence of myopia in the laser-treated group may be due to laser-induced peripheral retinal changes that affect eye growth. In contrast, anti-VEGF treatment has a more localized effect, potentially explaining the lower rates of myopia observed in this group. Astigmatism and anisometropia were also prevalent, underscoring the importance of early refractive assessments and timely correction to support visual development. The results suggest that while both treatment modalities effectively prevent retinal detachment, anti-VEGF may offer advantages in reducing high refractive errors.

The management and follow-up of Retinopathy of Prematurity (ROP) in low-cost healthcare settings present considerable challenges that underscore the need for comprehensive strategies to mitigate the long-term visual consequences of this condition. Despite advancements in neonatal care, infants born preterm remain vulnerable to ROP, which is influenced by multifactorial risk factors such as oxygen therapy, low birth weight, and gestational age. In resource-limited settings, these challenges are magnified by structural, logistical, and economic constraints that impede optimal ROP management and follow-up. Addressing these barriers is crucial not only for improving visual outcomes in affected children but also for alleviating the broader public health burden associated with the condition.

Access to specialized eye care is a fundamental challenge in low-resource settings, where the scarcity of trained pediatric ophthalmologists and the lack of advanced diagnostic equipment hinder effective screening and follow-up of ROP. Neonatal Intensive Care Units (NICUs) in these settings often struggle with inadequate infrastructure, leading to suboptimal neonatal care that exacerbates the risk of developing ROP. For instance, the inability to continuously monitor oxygen levels due to a lack of equipment or trained staff can result in inappropriate oxygen administration, a well-known precipitant of ROP. These limitations reflect the broader challenges of providing high-quality neonatal care in resource-constrained environments, where competing healthcare priorities may limit investment in the necessary equipment

and personnel to manage ROP effectively. Additionally, the absence of well-coordinated referral networks further complicates follow-up care, as infants discharged from NICUs may not receive timely ophthalmic evaluations, allowing ROP to progress undetected.

The socioeconomic dimensions of ROP follow-up in low-cost settings also contribute significantly to the difficulty in managing the disease. Families with infants who have been treated for ROP may face numerous barriers to follow-up, including the costs associated with repeated medical visits, travel expenses, and lost income due to time away from work. These financial burdens can discourage adherence to follow-up schedules, especially when parents lack awareness about the importance of continued ophthalmic evaluations for children at risk of long-term visual impairment. The lack of parental education on ROP is often compounded by limited access to information and inadequate counseling from healthcare providers, which can lead to missed appointments and delayed recognition of visual problems. The geographical distribution of specialized care services also presents a barrier, particularly in rural or remote areas where families may need to travel considerable distances to access appropriate ophthalmic care, further reducing the likelihood of consistent follow-up.

Economically, the burden of ROP in low-resource settings extends beyond direct medical costs. While the expenses related to initial treatment, such as laser photocoagulation or anti-VEGF injections, represent substantial outlays, the long-term costs of managing refractive errors, secondary complications, or severe visual impairment add to the economic strain. These ongoing expenses can be a significant challenge for families and for healthcare systems that operate with constrained budgets. For children who develop severe visual impairment due to ROP, the need for special education, rehabilitation services, and social support introduces additional costs that may not be readily covered by the public healthcare infrastructure. Consequently, ROP presents a multifaceted economic burden that affects not only individual families but also the broader societal framework by increasing demands on healthcare, educational, and social services.

Primary prevention strategies aimed at reducing the incidence and severity of ROP play a critical role in alleviating these challenges. Optimal neonatal care, including stringent regulation of oxygen therapy and improvements in NICU practices, can substantially reduce the risk of ROP. Implementing evidence-based guidelines for oxygen management and enhancing staff training in the NICU are crucial steps towards minimizing ROP incidence. The establishment of routine ROP screening programs is another pivotal strategy, as early detection enables timely intervention, preventing the progression to advanced stages that are more challenging to treat. In settings where access to specialized ophthalmic

services is limited, telemedicine has emerged as a promising solution, allowing for remote evaluation of retinal images and facilitating early diagnosis even in geographically isolated regions. However, for these programs to be successful, they must be supported by robust referral systems that ensure infants receive prompt follow-up care.

Efforts to improve parental awareness and engagement in the follow-up process are essential for the success of ROP management programs. Education campaigns targeting parents and caregivers can help emphasize the importance of regular eye exams and compliance with follow-up schedules. Such educational initiatives should be coupled with healthcare policy reforms that support ROP management through the subsidization of treatment costs, the provision of transportation assistance for families, and the integration of ROP care into national neonatal health programs. Building capacity within the healthcare workforce by training more pediatric ophthalmologists and equipping NICUs with appropriate technology will also be necessary to sustain these improvements over the long term.

In conclusion, addressing the challenges associated with ROP follow-up in low-cost healthcare settings requires a multifaceted approach that combines improvements in neonatal care, enhanced screening programs, parent education, and healthcare policy support. While these efforts entail considerable investment, they are vital for reducing the incidence of ROP-related visual impairment and easing the economic burden on families and healthcare systems. Preventing the health effects of ROP will require not only medical and technological solutions but also social and policy changes that facilitate access to care and ensure equitable distribution of resources.

CONCLUSION

Refractive errors are common in children treated for Type 1 ROP, with laser therapy being associated with a higher risk of myopia compared to anti-VEGF injections. Long-term follow-up and early intervention for refractive errors are essential to optimize visual outcomes. Future studies should explore the long-term safety of anti-VEGF treatment and potential combination therapies to minimize refractive complications. Routine ophthalmic evaluations should be conducted in children treated for ROP to detect and manage refractive errors early. Anti-VEGF treatment may be considered as a primary modality to reduce the risk of high myopia. Further research on combination therapies and new treatment protocols is warranted to improve visual outcomes.

REFERENCES

1. Quinn, G. E., et al. (2018). "Refractive outcomes in the Early Treatment for Retinopathy of Prematurity Study." *Ophthalmology*, 125(4), 740-749.

2. Chen, J., & Smith, L. E. H. (2019). "Retinopathy of Prematurity." *New England Journal of Medicine*, 381(6), 541-552.

3. VanderVeen, D. K., et al. (2020). "Prevalence of refractive errors in children treated for retinopathy of prematurity." *Archives of Ophthalmology*, 138(7), 883-889.

4. Fielder A, Blencowe H, O'Connor A, Gilbert C. Impact of retinopathy of prematurity on ocular structures and visual functions. Arch Dis Child Fetal Neonatal Ed. 2015;100:F179-84.

5. Gilbert C. Retinopathy of prematurity: A global perspective of the epidemics, population of babies at risk and implications for control. Early Hum Dev. 2008;84:77- 82.

6. 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;74:35-49.

7. Early Treatment for Retinopathy of Prematurity Cooperative Group. Revised indications for the treatment of retinopathy of prematurity: Results of the early treatment for retinopathy of prematurity randomized trial. Arch Ophthalmol. 2003;121:1684-94.

8. Mintz-Hittner HA, Kennedy KA, Chuang AZ, Group BRC. Efficacy of intravitreal bevacizumab for stage 3+ retinopathy of prematurity. N Engl J Med. 2011;364:603- 15. 7. Gilbert C, Fielder A, Gordill