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Retinopathy of Prematurity (ROP): Current Management Strategies

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Abstract

Worldwide, retinal deficiency of prematurity, or (ROP), continues to be a major cause of blindness and visual impairment in preterm infants. Control efforts face substantial obstacles as the frequency of ROP and its associated visual impairment continue to rise in some locations despite breakthroughs in newborn child care. The objective of this article is to present a summary of the current understanding of ROP, including risk factors, screening recommendations, pathophysiology, and therapy approaches. Premature children, especially those delivered before 32 weeks of pregnancy or weighing less than 1500 grammes at birth, are more susceptible to ROP because of aberrant retinal vascular development in these cases. ROP is influenced by a number of risk factors, which can include low birth weight, prolonged oxygen therapy, and systemic disorders. For the proper early detection and treatment of ROP, timely screening with retinal examination is essential. Surgical intervention in severe cases, anti-vascular endothelial growth factor (anti-VEGF) injections, laser therapy, and observation are among the management techniques for ROP. The results for newborns with ROP have improved thanks to developments in ophthalmology and neonatal care; yet, issues like long-term follow-up and access to care still need to be resolved.

Keyword: Retinopathy of Prematurity, premature infants; Incomplete vascularisation; Hypoxia; VEGF; Retinal Detachment; visual impairment.

INTRODUCTION

Premature newborns are the main target of Retinopathy of Prematurity, a proliferative vitreoretinopathy. There are more babies at risk of ROP globally, particularly in middle-income nations, as early deliveries rise and survival rates rise as a result of advancements in newborn care. The retinal vasculature in these premature baby's eyes is still developing, exposure of preterm low birth weight newborns to high concentrations of oxygen exceeding 40% is likely linked to the development of retrolental fibroplasia, often known as retinopathy of prematurity. The disease can be stopped in its tracks at any point. Using indirect ophthalmoscopy, the eyes of all newborns who have received supplemental oxygen and were born at or before 32 weeks gestational age or weighing 1.5 kg or less should be checked for ROP.

Epidemiology

ROP is now known to be the main cause of childhood blindness, having been originally

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reported in 1942. ROP affects 14,000–16,000 preterm infants in the United States each year, according to data from the National Eye Institute. Every year in the USA, ROP causes about 4001600 newborns to become legally blind.

India accounts for about 23.4% of the world's 14. 8 million preterm births per year. Preterm babies survive at a higher rate thanks to the growth and advancement in neonatal care. Retinopathy of prematurity (ROP) is a vaso proliferative retinal illness that can cause blindness in these babies and is more likely to occur in them. ROP treatment is required for about 5000 of the 490,000 preterm children born in India each year with a GA of less than 32 weeks.

In order to build a network of early intervention centres at the district level, Maharashtra's public private partnership (PPP) model was developed through cooperation between the state government, non-governmental organisations, and private service providers. The relevance of primary health care providers in raising parental awareness and enhancing compliance was also brought to light by the experiment. As a result of better coordination between the government and the mentor institute, Odisha state was able to decentralise the project in its entirety and accomplish sufficient infrastructure development and capacity building.

Risk Factors

1. **Maternal age:** Advanced maternal age has been associated with various adverse outcomes including miscarriage, intrauterine growth restriction, preterm births and chromosomal abnormalities. Multiple studies showed increased incidence with increasing maternal age, decreased incidence with increased maternal age.
2. **Prematurity:** Currently recognised as the two greatest risk factors for the development of ROP are birth weight and gestational age. The incidence of ROP is higher in infants born before 32 weeks of pregnancy or weighing less than 1500 grammes at birth.
3. **Oxygen:** Among the most often recognised risk factors for treatment requiring ROP are the use of supplemental oxygen, oxygen concentration, duration, and prolonged mechanical ventilation. Elevated oxygen levels and variations in oxygen saturation are independent risk factors for severe ROP. An increased risk factor for any severe ROP is extended mechanical breathing.
4. Anaemia, prolonged mechanical ventilation, respiratory distress syndrome, and variations in oxygen levels are additional risk factors.
5. **Pregnancy-related hypertension disorders:** preeclampsia and eclampsia are important risk factors for recurrent obstetric problems (ROP).
6. **Maternal diabetes mellitus:** This condition might affect the development of ROP directly (because of hyperglycemia's elevated retinal vascular endothelial growth factor) or indirectly (due to its link with respiratory distress syndrome).
7. **Maternal age:** Growing older mothers are more likely to experience miscarriages, intrauterine growth restriction, preterm deliveries, and chromosomal abnormalities, among other unfavourable consequences. Many research indicated that as maternal age grew, the incidence either reduced or increased.

Pathophysiology

The pathophysiology of ROP involves several key stages and factors:

- **Prematurity and Incomplete Vascularization**
  - ***Normal Retinal Development:*** In a full-term infant, retinal vascularization progresses from the optic nerve head outwards to the periphery, completing by about 40 weeks of gestation.
  - ***Premature Birth:*** When a baby is born prematurely, this vascularization process is incomplete, leaving parts of the retina avascular (lacking blood vessels).
- **Hyperoxia and Vaso-obliteration**
  - ***Oxygen Therapy:*** Preterm infants often require supplemental oxygen, which can lead to hyperoxia (high oxygen levels in the blood).
  - ***Vaso-obliteration:*** High oxygen levels inhibit vascular endothelial growth factor (VEGF), essential for blood vessel growth. This inhibition causes the regression or obliteration of existing retinal blood vessels.
- **Hypoxia and Vaso-proliferation**
  - ***Phase of Hypoxia:*** As the infant's oxygen levels are normalized, the avascular regions of the retina become hypoxic (low oxygen levels), triggering a pathological response.

- ***VEGF Surge:*** Hypoxia stimulates an overproduction of VEGF, leading to the formation of abnormal, fragile new blood vessels (neovascularization).

➢ **Pathologic Angiogenesis and Fibrosis**

- ***Abnormal Vessels:*** The newly formed blood vessels are prone to leakage and do not form normal vascular networks. They can extend into the vitreous, the gel-like substance filling the eye.
- ***Fibrovascular Proliferation:*** Alongside neovascularization, fibrous tissue can also form, leading to fibrosis.

➢ **Retinal Detachment and Vision Loss**

- ***Traction:*** The abnormal blood vessels and fibrous tissue can exert traction on the retina.
- ***Retinal Detachment:*** This traction can cause the retina to detach from the underlying tissue, leading to severe vision impairment or blindness if not treated promptly.

CLASSIFICATION

Table 1: International classification of retinopathy of prematurity

Stage	Features
Stage IA	Demarcation line between the vascularized and avascular retina.
Stage IIA	Ridge in place of the line.
Stage IIIA	Ridge plus extraretinal fibrovascular tissue.
Stage IVA	Subtotal retinal detachment. Phase I—when macula is spared. Phase II—when macula is involved.
Stage V	Total retinal detachment

Diagnosis and Screening

For prompt intervention and visual loss prevention, an early diagnosis of ROP is essential. exams should begin about 4-6 weeks after birth and continue until retinal vascularization is complete or the risk of retinal ophthalmoscopy has passed, according to screening guidelines. To evaluate the growth of the retinal blood vessels and spot any indications of ROP, ophthalmologists do routine eye exams.

TREATMENT OPTIONS

Depending on the severity and stage of the disease, there are many treatment options for ROP. The following are the main forms of treatment:

Observation

- Stages 1 and 2: These are the milder stages of ROP, which frequently don't need medical attention right away and can go away on their own. To make sure the issue doesn't worsen, it must be regularly monitored with eye exams.

Laser Therapy

- ***Stage 3:*** Photocoagulation, or laser therapy, is frequently used to treat Stage 3 ROP. By burning and sealing the retina's borders with laser beams, this procedure stops the growth of aberrant blood vessels that could otherwise lead to retinal detachment.
- ***Procedure:*** It is usually carried out at a hospital or speciality eye clinic while under anaesthesia.

Cryotherapy

- ***Stage 3:*** Another method for treating Stage 3 ROP is cryotherapy, which involves applying extremely cold temperatures to the retina to cause scarring. This aids in halting aberrant blood vessel expansion.
- ***Procedure:*** Cryotherapy is done under anaesthesia, just like laser therapy.

Anti-VEGF Injections

- ***Stages 3 and 4:*** Anti-vascular endothelial growth factor (anti-VEGF) injections administered intravitreal are used to prevent the formation of aberrant blood vessels. One such medicine is bevacizumab (Avastin).
- Procedure: These injections can be used either alone or in combination with laser therapy, and they are given straight into the eye.

Surgical Intervention

- ***Stage 4 and 5:*** Surgery might be required in severe situations (Stages 4 and 5) where there is a partial or complete retinal detachment.
- ***Scleral Buckling:*** The detached retina is gently pushed back into place during this surgery by wrapping a silicone band around the eye.
- ***Vitrectomy:*** To reconnect the retina, the vitreous gel that fills the eye is removed during this procedure and replaced with a saline solution or gas bubble.

Follow-Up and Long-Term Care

1. Regular follow-up checks are necessary for infants receiving ROP treatment to assess their visual progress and make sure no issues or recurrences occur.
2. Children who have visual impairments or other disorders related to their eyes may require further treatments or interventions as they get older.

Prevention and Screening

1. Preterm Birth: Reducing the incidence of ROP mostly involves preventing preterm birth through appropriate prenatal care.
2. Screening: For early detection and prompt treatment, routine eye exams are essential for premature newborns. These examinations should begin 4-6 weeks after delivery or before the infant reaches the postmenstrual age of 31 weeks.

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