



# **Retinopathy of Prematurity: Does the care we provide make a difference?**

**Deb Fraser, MN, RNC**

# Agenda

- Review incidence of and risk factors for ROP
- Outline strategies to prevent ROP
- Our role in the prevention of ROP

# What is ROP

Disorder occurring predominantly in premature infants

Characterized by arrest of normal vascularization of the retina followed by proliferation of abnormal vessels

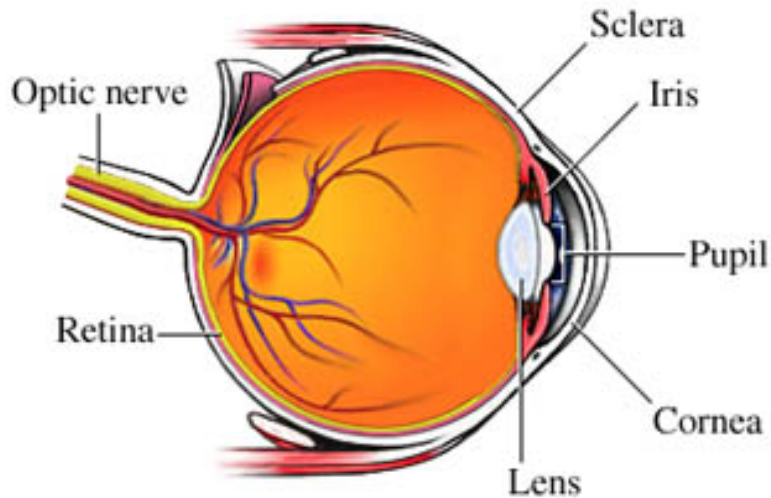
# Incidence of ROP

- Inversely related to birth weight and gestational age
- Wide variation in reported incidence because of differences in screening criteria, ages included and population characteristics
- For infants < 29 weeks overall incidence is 40%-53% with 10% having severe ROP and 2-5% reaching treatment threshold
- (O'Connor 2003, Good et al 2005, Hussain et al 1999)



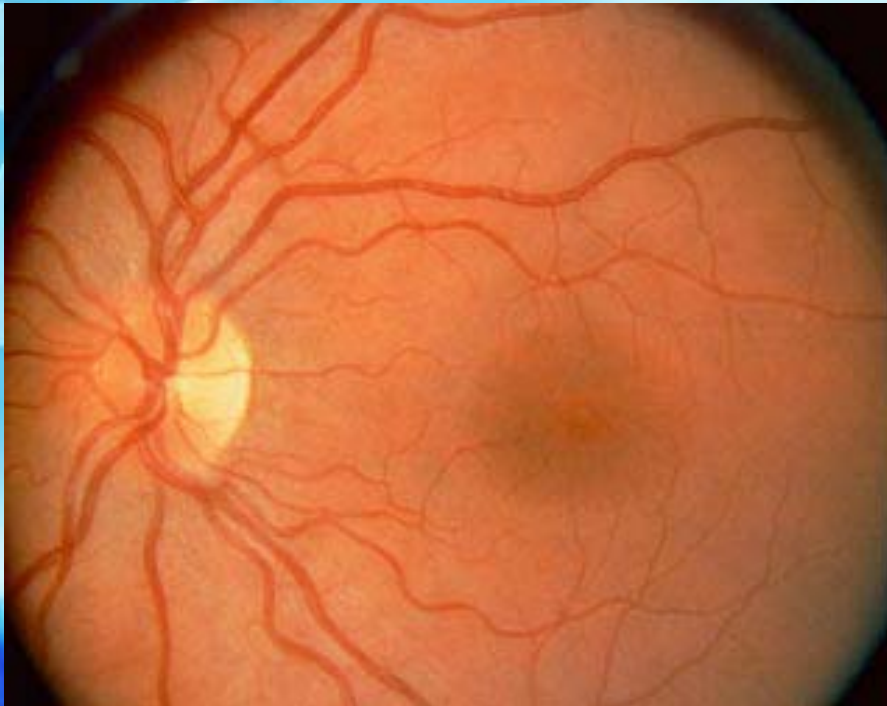
# What is ROP

- *In utero* the retina is avascular until 16 weeks
- Spindle cells begin branching from the fetal optic nerve and grow outward to the ora serrata (anterior edge of retina)



<http://healthgate.partners.org>

# What is ROP



- Blood vessels reach the temporal edge of the retina by 40-44 weeks
- This development normally takes place in a hypoxic environment (PaO<sub>2</sub> of ~30) under the influence of VEGF and IGF-1

# What is ROP

- ACUTE PHASE

- With preterm birth hyperoxia suppresses VEGF → cessation of vessel growth and vasoconstriction of immature vessels (Stage 1 ROP)
- Acute phase occurs at 30-32 weeks PMA



# Phase 2 ROP

- With retinal growth metabolic demands increase → tissue hypoxia
- Tissue hypoxia → angiogenic response and new vessel growth (neovascularization) (Stage 2 ROP)
- Vessels form at the junction of the vascularized and non-vascularized portions of the retina





# Pathophysiology of ROP

- If circulation to central retina reestablished, ROP regresses
- Aggravation of the process leads to growth of new blood vessels outward from the ridge into the vitreous (Stage 3 ROP)
- Scar tissues forms which puts traction on the retina causing detachment (Stage 4a, 4b and 5)

# Risk Factors

- Birthweight and gestational age universal
- Also
  - Oxygen exposure
  - Degree of illness
  - Blood transfusions
  - Mechanical ventilation
  - Apnea
  - Infection
  - Race- south Asian>Caucasian>African American
  - Country of birth- middle income countries worse

# Screening

- AAP guidelines (2006)
- All infants <32 weeks or birthweight <1500 grams
- Babies 1500-2000 with unstable clinical course
- Start exams when infant <27 weeks reaches 31 weeks or at 4-6 weeks for infants born at 28-32 weeks





# Screening

- Experienced ophthalmologist
- Dilating drops
- Follow-up screening according to the findings and the degree of vascularization present
- required in one week or less for infants with stage 1 or 2 ROP in Zone I or stage 3 ROP in Zone II.

# Making Screening Happen

- Every NICU should have a program in place
  - to identify infants who meet screening criteria
  - To schedule eye examinations.
- **When an at-risk infant is discharged or transferred availability of appropriate follow-up has to be considered.**

# Remote Screening



- Retcam- high powered camera capable of capturing and transmitting retinal images
- May allow for remote follow-up of at-risk infants



# Nurses and screening



- Nurses may also play a role in ensuring that the screening guidelines are adhered to
- Need a carefully planned system with involvement of nurses, neonatologist and ophthalmologist



# Screening policies

- Joint agreement on who gets screened and when
- Plan for notification of readiness for screening
- Plan for timing of actual screen, orders for dilating eye drops, sucrose or other pain management measures, feeding schedules etc

# Timing is Critical

- ROP changes very quickly
  - Can go from stages 1 to 5 in a couple of weeks
  - ETROP study shows treatment should be done in 48 hours instead of 72 hours.
- The majority of prethreshold and threshold ROP occurs at 36-39 weeks

PMA



# Outcome



- Depends on stage of disease, whether or not macula is involved
- Stage 1 and 2- resolve spontaneously but may be at risk for myopia, amblyopia, astigmatism and strabismus

# Outcome

- Untreated threshold disease leads to blindness in 50% of cases
- Treatment at threshold disease- 82% of treated eyes had good anatomic outcomes (no detachment, folds or retinal distortion but high risk of visual problems)
- 35 % functional failure rate (< 80/20 vision)

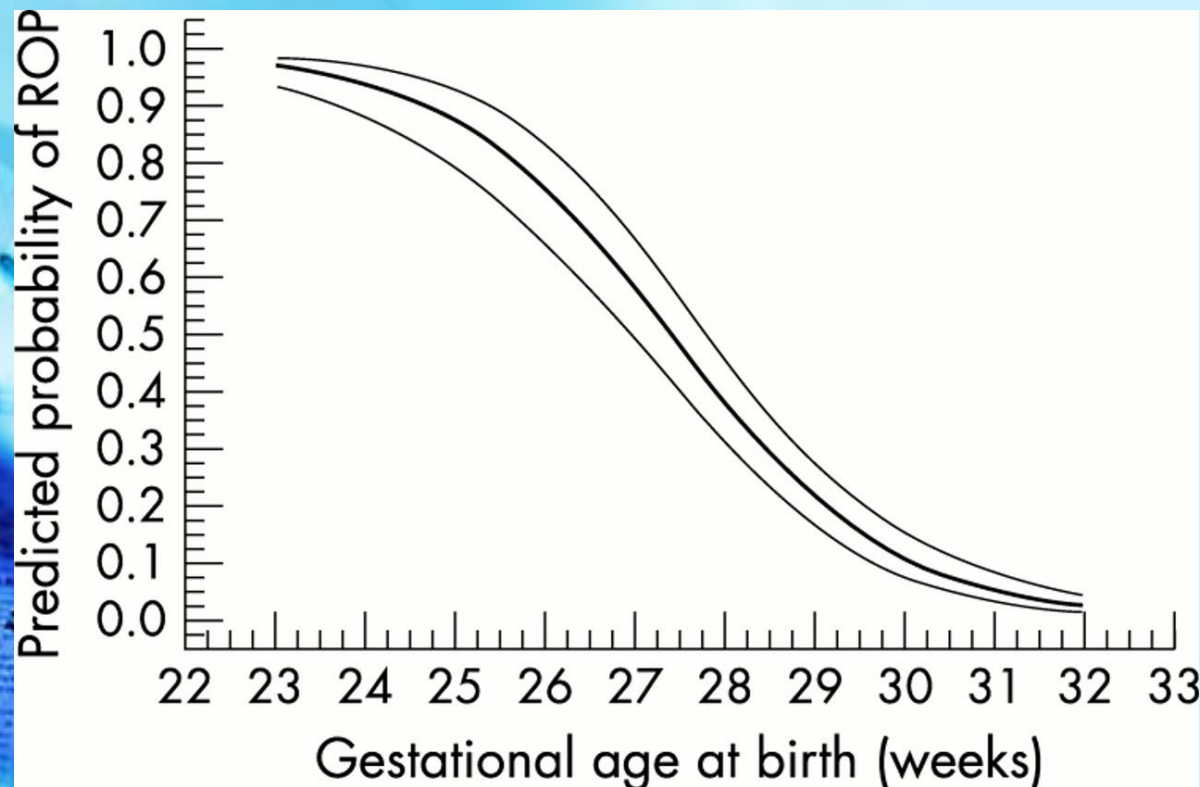
# Preventing ROP

- 1<sup>st</sup>-prevent preterm birth
- Aim to decrease co-morbidities
  - BPD, IVH, pneumothorax and sepsis
- Avoid hyperoxia
- Encourage breastfeeding



# Preventing ROP

- Prevent preterm birth
  - There is a clear association between decreasing gestation age and the risk of ROP



Brit J Ophthalmol, 2002

# Infection and ROP

- A review of 1646 infants <30 weeks examining risk factors for ROP found that
  - for infants 23-25 weeks, oxygen-associated risks were more prominent
  - For infants 28-29 weeks, infection was a prominent risk factor
- Chen et al Neonatology 99(2) 125-132

# Hospital-acquired infections

- A major concern in low birth weight infants
- Good hand hygiene
- Central line “bundles”
- Care practices for reducing ventilator-acquired pneumonia



# Role of Oxygen

- Early studies linked ROP to exposure to high levels  $O_2$
- Doesn't explain ROP in infants exposed to minimal or no oxygen
- New studies have found decreased severe ROP when oxygen levels are targeted to maintain sats 85-93 (Chow *et al* 2003, VanderVeen *et al* 2006)
- Fluctuating  $PaO_2$  levels found to increase risk of threshold ROP in vulnerable infants
  - (York *et al* 2004)

# More than just oxygen

- The ELGAN study
  - 1,042 infants < 28 weeks
  - Analysis of blood gas results showed that infants with blood gas abnormalities on at least 2 of the first 3 days of life were at greater risk of severe ROP\
  - In particular high PCO<sub>2</sub>, high PO<sub>2</sub> and low pH
    - Hauspurg et al Neonatology 99(2) 104-111

# Prevention starts early



- Consider delivery room practices
  - Fetal oxygen saturation levels are about 60%
  - For infants <32 weeks start at 40% oxygen (not 100) and adjust as needed



# Prevention starts early



- Apply a pulse oximeter in the delivery room
- Set target saturations levels lower for the first few minutes of life



# What about the nursery?



- Prevention remains key
- Judicious use of oxygen!
- Oxygen targeting is only possible with when all care-providers work together'

# Targeting oxygen works

- Chow et al
  - Incidence of ROP decreased from 12.5% to 2.5%. Need for laser tx ↓ from 4.5% to 0%
  - How did they do it?
    - Oxygen management policy, strict guidelines for O<sub>2</sub> sats beginning in DR, transport and hospitalization
    - Sats 85-92 for infants <32 weeks
    - Weaning guidelines and guidelines for responding to desats- no increases in O<sub>2</sub> to 'chase' desats



# Oxygen targeting works

- In the Chow study (Peds 2003) nurses and respiratory therapists signed a contract to signify they were willing to comply with unit's O<sub>2</sub> policy
- Build a team that understands the plan!



# OWL with love

- Oxygen targeting program established by Jay Goldsmith at Oschsner in New Orleans
- An Owl at the bedside reminds everyone of the targeted oxygen saturation ranges. This program resulted in and 80% compliance and a similar reduction in ROP.

# Summary

- ROP is a disease of VLBW infants
- The incidence of severe ROP may be reduced by careful use of oxygen but cannot be eliminated by this alone
- Future research will likely result in measures to target VEGF and IGF-1
- Appropriate screening and follow-up is critical to identify infants reaching prethreshold disease



# Summary



- Prompt treatment of prethreshold disease can reduce the incidence of poor visual outcomes
- Health care providers play a critical role in most of these steps!