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 (PaO2 of ~30) under the influence of VEGF and IGF-1

www.eyesondiabetes.org
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

[link: telemedicine.orbis.org/bins/content_page.asp]...
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

medgadget.com/
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

- 1st-prevent preterm birth
- Aim to decrease co-morbidities
  - BPD, IVH, pneumothorax and sepsis
- Avoid hyeroxia
- 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 $\text{PaO}_2$ 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 PC02, high P02 and low pH
  - Hauspurg et al Neonataology 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 \( \downarrow \) from 4.5% to 0%
  - How did they do it?
    • Oxygen management policy, strict guidelines for O2 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 O2 to ‘chase’ desats

Chow et al 2003 Pediatrics 111(2)
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 $O_2$ policy
- Build a team that understands the plan!
• 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!