PRACTICE POINT

Retinopathy of prematurity: Recommendations for screening

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Abstract

Retinopathy of prematurity (ROP) is a disorder of the developing retinal blood vessels of the preterm infant. New recommendations for screening and treatment of ROP have been published in the past few years. Current evidence suggests that screening infants with gestational ages of 30 6/7 weeks or less (regardless of birth weight) and birth weights of 1250 g or less is a strategy with a very small likelihood that an unscreened baby would have treatable ROP. Individual centres may choose to extend birth weight screening criteria to 1500 g. Initial screening should be performed at 31 weeks' postmenstrual age in infants with gestational ages of 26 6/7 weeks or less at birth, and at four weeks' chronological age in infants with gestational ages of 27 weeks or more at birth by an ophthalmologist skilled in the detection of ROP. Follow-up examinations are conducted according to the ophthalmologist's recommendation. Infants with high-risk prethreshold ROP and threshold ROP are referred for retinal ablative therapy. Developing processes for ROP screening, documenting results and communicating results to parents as well as health professionals involved in the infant's care are important responsibilities for all nurseries providing care for preterm infants.

Key Words: *Laser therapy; Preterm infant; Retinopathy of prematurity; Screening*

Retinopathy of prematurity (ROP), a disorder of the developing retinal blood vessels of the preterm infant, may lead to poor visual acuity or blindness. ROP has also been associated with poor neurodevelopmental outcome [1]. Retinal ablative therapy significantly decreases the likelihood of a poor visual outcome [2]. It is, therefore, essential that health professionals know whom and when to screen for ROP in preterm infants. In 1998, the recommendations for ROP screening were published as a Canadian Paediatric Society (CPS) clinical practice guideline [3]. Since this time, several studies have provided new information, and new guidelines for screening and treatment have been published by the American Academy of Pediatrics (AAP) in 2006 [4] and by the Royal College of Ophthalmologists and the Royal College of Paediatrics and Child Health, United Kingdom, in 2008 [5]. The present practice point briefly reviews the new information and summarizes current recommendations for the detection and treatment of ROP. These recommendations replace those in the previous CPS clinical practice guideline.

Classification of ROP

The International Classification of Retinopathy of prematurity that describes ROP by location (zones) and severity (stages), as well as defines plus and pre-plus disease, was updated in 2005 [6]. Definitions are summarized in Table 1, and zones of the retina are shown in Figure 1.

Table 1
Classification of retinopathy of prematurity

Stage 1	Demarcation line separates avascular from vascularized retina
Stage 2	Ridge arising in region of demarcation line

Stage 3	Extraretinal fibrovascular proliferation / neovascularization
Stage 4	Partial retinal detachment
Stage 5	Total retinal detachment
Pre-plus disease	More vascular tortuosity than normal, but insufficient for diagnosis of plus disease
Plus Disease	Vascular dilatation and tortuosity of at least two quadrants of the eye

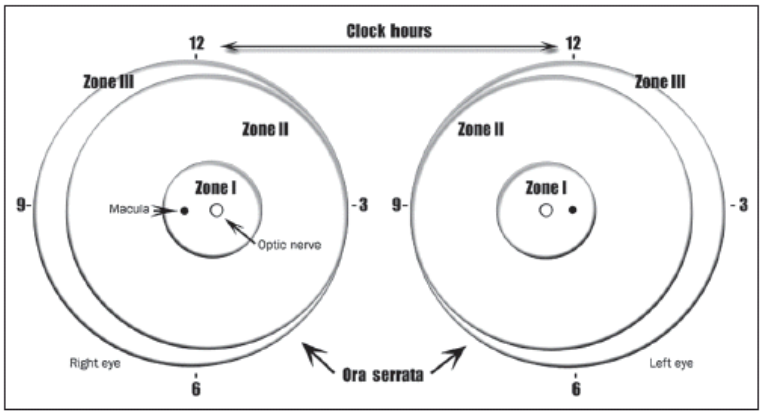

Figure 1) *Scheme of retina of the right and left eyes showing zone borders and clock hours used to describe the location and extent of retinopathy of prematurity. Reproduced with permission from reference 4*

Screening for ROP

Whom to screen

In 1998, the CPS recommended screening infants born at 30 weeks' gestational age (GA) or less, or with a birth weight of 1500 g or less [3][7]. The birth weight criterion was included because of uncertainty in determining GA. Similar criteria (birth weight less than 1500 g or GA of 30 weeks or less) were recommended by the AAP in 2006 [4]. The 2008 United Kingdom guideline development group reviewed 23 articles involving 10,481 screened babies and found only one infant requiring treatment who was more than 30 weeks' GA and weighed more than 1250 g at birth [5]. Using evidence from these published cohort studies, the United Kingdom guideline recommended screening all infants with GA up to 30 6/7 weeks or with birth weights of less than 1251 g. The option of using broader screening criteria (babies up to 31 6/7 weeks' GA or with birth weights of less than 1501 g) was included based on clinical experience. More recent publications [8]-[12] reporting both birth weight and GA provided additional support for using the criteria of GA of 30 6/7 weeks or less or birth weights of 1250 g or less. Three articles [13]-[15] described Canadian experience, and documented only one infant requiring therapy who fell outside of the GA of 30 6/7 weeks or less or 1250 g or less criteria. Data obtained from the Canadian Neonatal Network between 2003 and 2007 showed that of 1432 infants of more than 30 weeks' GA who were screened, three developed ROP of stage 3 or greater and one required treatment (P Shah, personal communication). These data suggest that if all infants with GA of 30 6/7 weeks or less (regardless of birth weight) as well as any infant with a birth weight of 1250 g or less are screened, the likelihood of an unscreened infant developing advanced stage ROP, for which treatment should be offered, is extremely low.

When to screen

ROP takes the longest to develop in the most immature infants. Data from two large clinical trials – the Multicenter Trial of Cryotherapy (CRYO-ROP) study and the Light Reduction in Retinopathy of Prematurity (LIGHT-ROP) study – have been used to provide evidence-based criteria for initiating and stopping ROP screening [16]. Together, these trials examined the eyes of approximately 4500 infants. The recommendations were developed to ensure that eyes that had a high probability of requiring treatment would be identified in a timely manner, while at the same time minimizing the number of examinations for infants at low risk. Timing of the initial examination is based on both postmenstrual age (PMA) and chronological age (CA), and is undertaken to detect 99% of infants at risk of a poor visual outcome. As per Table 2, the first examination is conducted between four and nine weeks' CA, depending on PMA at birth. Subsequent studies [17][18] have confirmed the efficacy of conducting the first examination at four weeks' CA in more mature infants. Acute phase ROP screening may stop when the risk of developing severe ROP is no longer present. It was found that 99% of prethreshold ROP develops by 45 weeks' PMA.

Table 2
Initial screening for retinopathy of prematurity

Gestational age at birth, weeks	Age at initial examination, weeks	
	Postmenstrual age	Chronological age
22	31	9
23	31	8
24	31	7
25	31	6
26	31	5
27	31	4
28	32	4
29	33	4
30	34	4
31	35	4
32	36	4
Adapted with permission from reference [4]		

These GA criteria emphasize the importance of accurate pregnancy dating.

On the basis of studies published to date, it is not possible to confidently define a subset of preterm infants who fall within screening criteria in whom the risk of developing ROP is increased or decreased and, therefore, screening could be modified. The ability of poor postnatal weight gain to predict severe ROP is promising [19], but further confirmation is required. The role of digitalized imaging for routine ROP screening is not resolved at this time.

Treatment of ROP

Treatment of ROP is based on the principle of retinal ablation. Treatment is directed to the avascular part of the retina with the goal of decreasing the production of angiogenic growth factors. The effectiveness of cryotherapy and laser photocoagulation (the preferred treatment method) in reducing poor visual and structural outcomes of eyes with threshold ROP is well established [2]. However, despite treatment, the incidence of unfavourable outcome for these infants remains significant. Results of the Early Treatment for Retinopathy of Prematurity (ETROP) randomized trial [20] have shown that treatment of eyes with high-risk prethreshold ROP further reduced unfavourable visual acuity and structural outcomes. Based on the results of this trial, indications for treatment have been refined.

The effectiveness of intravitreal injection of antivascular endothelial growth factor antibodies as treatment for ROP is under study.

Summary of current recommendations

Which infants should be screened

Current evidence suggests that screening infants with the following:

- GA of 30 6/7 weeks or less (regardless of birth weight); AND
- birth weights of 1250 g or less

as recommended by the United Kingdom [5], is an appropriate strategy with a very small likelihood that an unscreened baby would have treatable ROP. Individual centres may choose to extend birth weight screening criteria to 1500 g, as recommended by the AAP [4]. Screening of infants with birth weights of between 1251 g and 2000 g is appropriate if the neonatologist believes the baby to be at high risk because of the severity and complexity of the neonatal clinical course. Risk factors may include severe and unstable respiratory disease, hypotension requiring inotropes and prolonged ventilatory or oxygen therapy [10][11].

Who should conduct screening

Ophthalmologists skilled in the identification of ROP including location and staging as described in the International Classification of Retinopathy of

Prematurity revisited [6].

When should initial screening be performed

(Table 2)

- Infants with GA of 26 6/7 weeks or less at birth – initial screen at 31 weeks' PMA;
- Infants with GA of 27 weeks or more at birth – initial screen at four weeks' CA.

Pain relief

The discomfort and systematic effects of the eye examination should be minimized by the use of topical anesthetics and the use of pacifiers, swaddling or sucrose.

Follow-up examinations

Follow-up examinations should be recommended by the examining ophthalmologist. The AAP suggested schedule is the following:

- One week or less follow-up:
  - Stage 1 or 2 ROP in zone I
  - Stage 3 ROP in zone II.
- One- to two-week follow-up:
  - Immature vascularization (stage 0) in zone I
  - Stage 2 ROP in zone II
  - Regressing ROP in zone I.
- Two-week follow-up:
  - Stage 1 ROP in zone II
  - Regressing ROP in zone II.
- Two- to three-week follow-up:
  - Stage 1 or 2 ROP in zone III
  - Regressing ROP in zone III.

Treatment

Retinal ablative therapy should be considered for high-risk prethreshold ROP:

- Zone I – any stage ROP with plus disease.
- Zone I – stage 3 ROP with or without plus disease.
- Zone II – stage 2 or 3 ROP with plus disease.

Retinal ablative therapy should be performed for threshold ROP (at least five contiguous or eight cumulative clock hours of stage 3 ROP in zone 1 or 2 in the presence of plus disease). Treatment should be performed within 72 h of examination.

Duration of acute ROP screening

Cessation of ROP screening depends on eye findings and PMA. AAP indications for stopping screening examinations include the following:

- Complete vascularization;
- Zone III vascularization without previous zone I or II ROP;
- PMA of 45 weeks and no prethreshold disease or worse ROP;
- Regression of ROP.

Long-term follow-up

Infants who have had ROP are at risk of poor visual acuity and other visual disturbances, regardless of whether treatment was required. These infants require long-term ophthalmological follow-up.

Responsibilities in ROP screening

- All nurseries that provide care for infants at risk of ROP must have criteria and procedures to ensure appropriate ROP screening.
- Results of ROP screening must be documented and communicated to parents. Parents of infants with severe ROP should be aware that there is a risk of poor visual outcome even with therapy.
- If infants are transferred from one unit to another, arrangements must be made for appropriate ophthalmological follow-up. Results of ROP screening must be accurately communicated to the receiving unit.
- Discharge planning must include arrangements for any indicated ophthalmological examinations and follow-up. Parents should understand the importance of these examinations.

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taking into account individual circumstances, may be appropriate. Internet addresses are current at time of publication.