Screening for Retinopathy of Prematurity in China: A Neonatal Units–Based Prospective Study

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Purpose. To analyze the incidence and severity of retinopathy of prematurity (ROP) in China, and to explore the workload implications of applying different criteria.

Methods. A prospective, neonatal units–based study undertaken in two tertiary level hospitals in Shanghai, China, from January 1, 2010 to December 31, 2012. All infants with birth weight (BW) of 2000 g or less and/or gestational age (GA) of 34 weeks or less were screened for ROP. Retinopathy of prematurity was classified using the international classification, and was treated in accordance with the recommendations of the Early Treatment for Retinopathy of Prematurity Cooperative Group.

Results. A total of 2825 (93.7%) of 3014 eligible infants were screened, and ROP was diagnosed in 503 infants (17.8%). One hundred ninety-one infants (6.8%) had type 1 or worse ROP and were treated with laser or vitrectomy. The mean GA of ROP patients was 29.9 ± 2.1 weeks and their mean BW was 1425 ± 266 g. Infants who needed treatment for ROP had a mean GA of 29.3 ± 2.1 weeks and mean BW of 1331 ± 330 g. Among these treated infants, 18 infants (9.4%) exceeded the United Kingdom's (UK) screening criteria, and 28 (14.7%) exceeded the criteria used in the United States (US). If narrower criteria, as in GA less than or equal to 33 weeks and/or BW less than or equal to 1750 g were adopted, almost 16.9% fewer infants would not have been examined, with no infant missing treatment.

Conclusions. Larger, older infants are at risk in China and screening criteria used in the US and UK may not be suitable for China. Further population-based studies are recommended to determine the necessity of modifying the current ROP screening protocol.

Keywords: retinopathy of prematurity, screening criteria, China

摘要

目的：调查分析中国上海地区早产儿视网膜病变的患病率，并对目前我国现行筛查标准的有效性进行评估。

方法：以新生儿监护室为基础的前瞻性研究。对 2010 年 1 月至 2012 年 12 月期间出生体重≤2000g 或出生时孕周≤34w 早产儿进行眼底筛查。根据国际分期对 ROP 进行分级，并按照 ETROP 治疗组推荐方案进行治疗。

结果：3014 例早产儿中共有 2825 例患儿（93.7%）完成了眼底筛查。有 503 例（17.8%）患儿诊断为 ROP，他们的平均出生时孕周为 29.9±2.1 周，平均出生体重为 1425.1±265.1 克。有 191 例患儿（6.8%）因患 1 型阈值前病变或更严重的病变而接受激光或玻璃体手术治疗，他们的平均出生时孕周为 29.3±2.1 周，平均出生体重为 1330.5±330.4 克。接受治疗的患儿中，有 18 例患儿（9.4%）在英国 ROP 筛查标准之外，有 28 例患儿（14.7%）在美国筛查标准之外。如果我们将筛查标准缩小到出生时孕周≤34w 和/或出生体重≤1750g，将有 16.3%的患儿无需进行检查且不会遗漏任何一例需要进行治疗的患者。

结论：与发达国家相比，我国 ROP 患儿存在出生体重相对重，孕周相对高的特点。英美等国的筛查标准不适合我国国情。需要进一步进行以人群为基础的研究以明确是否需要修改目前的筛查标准。

Retinopathy of prematurity (ROP), which is a leading cause of childhood blindness, is characterized by abnormal vascular development of the retina in premature infants.[1] In the last decade or so, an increasing frequency of ROP blindness has been documented in middle income countries and urban areas of low income countries where neonatal care is rapidly improving with survival of less mature and smaller infants.[1,2] This is referred to as a "third epidemic" of ROP. China is a middle income country and has continued advances in neonatal management, including the use of surfactant therapy and new methods of mechanical ventilation, which improves the survival rates for premature infants,[3] and is experiencing an increasing number of ROP. The study by Chen et al.[4] suggested that ROP is becoming an important cause of blindness in China. However, there are scarce data regarding the current incidence of ROP in China.

Birth weight (BW) and gestational age (GA) have been accepted as major risk factors for the development of ROP, and most screening guidelines have been based on these factors to identify infants needing examination. Several studies have evaluated and proposed criteria for ROP screening.[5–9] The objective of all studies was to minimize the number of infants for screening, while missing no infants with ROP who required treatment. In the United States (US), a multidisciplinary group recommended screening criteria in 1997, which were revised in 2001, 2006, and 2013.[5–7] The current US criteria suggest that infants with BW of less than or equal to 1500 g or GA of less than or equal to 30 weeks should be examined, as well as more mature infants with an unstable clinical course. United Kingdom (UK) guidelines were developed in 1990 and were revised in 1995 and 2008.[8,9] The current UK criteria state that infants with BW of less than 1251 g or GA of less than 31 weeks must be screened for ROP and infants with BW of 1251 to less than 1501 g or GA of less than 32 weeks should also be examined.

Since the neonatal health care is different from one country to another,[3,10] the UK and US's screening criteria might not be appropriate for detecting all infants at risk in middle income countries.[2] In China, the ROP screening guidelines were recommended by the Ministry of Health in 2004, which specify that infants who meet the following criteria need to be screened for ROP: BW of less than or equal to 2000 g and/or GA of less than or equal to 34 weeks. The guidelines include more mature infants than the US and UK criteria, in order not to miss infants needing treatment, but this has increased the workload for pediatric ophthalmologists. Neonatal care in China has improved significantly over recent years, but few studies have addressed whether the 2004 guidelines are the still applicable.

The aims of this article are to report the incidence of ROP and to test the effectiveness of current China ROP screening guidelines based on examinations of high-risk, premature infants in two tertiary level neonatal intensive care units (NICUs) in Shanghai, China.

Methods

Study Design

This was a prospective study of infants who were admitted in the tertiary level neonatal intensive care units at Xinhua Hospital affiliated with Shanghai Jiao Tong University and Children's Hospital of Fudan University in Shanghai, China. The study was approved by the institutional ethics committee and was performed in accordance with the Declaration of Helsinki. The study included infants born between January 1, 2010 and December 31, 2012, who underwent ROP screening at the two institutions. Informed consent was obtained from all parents of enrolled infants prior to each screening. A

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Table 1. Baseline Characteristics of the Study Population

	No ROP	ROP	*P*
Number	2322	503	
GA, mean ± SD, wk	32.1 ± 2.0	29.9 ± 2.1	<0.001
Range	24~36	24~36	
BW, mean ± SD, g	1788 ± 387	1425 ± 266	<0.001
Range	650~3430	650~3350	
Sex, male:female	1353:969	312:191	0.120
Multiple birth	544	80	<0.001

special written consent was obtained prior to laser or other treatments.

Screening Criteria

Examinations were carried out according to the Screening Guidelines for ROP in China as follows: (1) GA less than or equal to 34 weeks, (2) BW less than or equal to 2000 g, and (3) any infant, irrespective of BW or GA, who may have been ventilated for at least 1 week or received supplemental oxygen for more than 30 days. The neonatologists determined the GA for each infant on the basis of the mother's report of the date of her last menstrual period and neonatal physical assessment using the New Ballard Score.

Babies who died before they could be examined or before full vascularization of the retina, or those who did not complete the follow-up protocol for other reasons were excluded from the study.

Clinical Eye Examinations

The first ROP screening examination was performed on infants of GA less than or equal to 34 weeks in 4- and 6-weeks postnatal age, and on infants of GA greater than 34 weeks in postnatal weeks 2 and 3 by pediatric ophthalmologists.

Pupils were dilated with a combination of tropicamide 0.5% and phenylephrine 0.5% eye drops, instilled 1 hour before examination. Indirect ophthalmoscopy was performed using a 28-diopter (D) lens and, when required, a lid speculum and scleral indentor was used after topical anesthesia (proparacaine; Alcon Laboratories, Inc., Fort Worth, TX) instillation. The stages of ROP were classified according to the International Classification of Retinopathy of Prematurity (ICROP, 2005).[11]

Monitoring and Management of Infants at Risk of ROP

If no ROP was detected at the initial examination, the infants were re-evaluated once every 2 weeks until vascularization had reached zone 3. If ROP was detected, the examinations were performed weekly until the disease progressed to a stage requiring treatment, or established ROP was definitely regressing.

Indications for treatment included eyes with type 1 ROP and aggressive posterior ROP (AP-ROP). Infants were treated within 24 hours of diagnosis. A diode laser photoablation was performed in the operation room under topical anesthesia and the infants were monitored by a neonatologist during the treatment. Confluent laser burns, defined as laser burns less than half a burn width apart, were applied to the entire avascular retina. Repeated laser treatment to skip areas was carried out in 7 to 14 days after the primary treatment. Some eyes underwent a lens-sparing vitrectomy (LSV) as they had progressed to retinal detachment despite early, confluent, and adequate laser treatment.

Statistical Analysis

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) Version 17.0 (IBM Corporation, Armonk, NY). Significance level was set at less than 0.05 for χ^2 test and Fisher exact test. For some of the analyses, infants were divided into three groups: no ROP, mild ROP (i.e., developed ROP that did not require treatment), and severe ROP, which required treatment. Differences in BW and GA among the three groups were analyzed using one-way ANOVA analysis.

Results

From January 2010 to December 2012, a total of 3014 preterm infants were eligible for examination. One hundred twenty-two

Table 2. Numbers and Proportions of Infants Developing Different Stages of ROP, According to BW and GA

	No ROP, *N* (%)	ROP Stage 1, *N* (%)	ROP Stage 2, *N* (%)	ROP Stage 3, *N* (%)	AP-ROP, *N* (%)	Total, *N*
BW, g						
≤750	5 (62.5)	1 (12.5)	2 (25.0)	0 (0)	0 (0)	8
751–1000	40 (44.0)	8 (8.8)	27 (29.7)	9 (9.9)	7 (7.7)	91
1001–1250	179 (56.6)	23 (7.3)	71 (22.5)	32 (10.1)	11 (3.5)	316
1251–1500	323 (70.1)	31 (6.7)	68 (14.8)	34 (7.4)	5 (1.1)	461
1501–1750	501 (86.5)	21 (3.6)	45 (7.8)	9 (1.6)	3 (0.5)	579
1751–2000	662 (90.8)	20 (2.7)	34 (4.7)	13 (1.8)	0 (0)	729
>2001	612 (95.3)	8 (1.2)	17 (2.6)	3 (0.5)	2 (0.3)	642
Total	2322 (82.2)	112 (4.0)	264 (9.3)	99 (3.5)	28 (1.0)	2825
GA, wk						
≤26	12 (37.5)	1 (3.1)	9 (28.1)	8 (25.0)	2 (6.3)	32
27–28	114 (45.1)	25 (9.9)	72 (28.5)	31 (12.3)	11 (4.3)	253
29–30	356 (70.5)	30 (5.9)	80 (15.8)	31 (6.1)	8 (1.6)	505
31–32	737 (84.2)	43 (4.9)	68 (7.8)	23 (2.6)	4 (0.5)	875
33–34	918 (94.8)	10 (1.0)	31 (3.2)	6 (0.6)	3 (0.3)	968
>34	185 (96.4)	3 (1.6)	4 (2.1)	0 (0)	0 (0)	192
Total	2322 (82.2)	112 (4.0)	264 (9.3)	99 (3.5)	28 (1.0)	2825

Table 3. Incidence of No ROP, Mild ROP, and Severe ROP, According to BW and GA

	No ROP, *N* (%)	Mild ROP, *N* (%)	Severe ROP, *N* (%)	Total, *N*
BW, g				
≤750	5 (62.5)	2 (25.0)	1 (12.5)	8
751–1000	40 (44.0)	24 (26.3)	27 (29.7)	91
1001–1250	179 (56.6)	72 (22.8)	65 (20.6)	316
1251–1500	323 (70.1)	85 (18.4)	53 (11.5)	461
1501–1750	501 (86.5)	57 (9.8)	21 (3.6)	579
1751–2000	662 (90.8)	51 (7.0)	16 (2.2)	729
>2001	612 (95.5)	21 (3.3)	8 (1.2)	641
Total	2322 (82.2)	312 (11.0)	191 (6.8)	2825
GA, wk				
≤26	12 (37.5)	3 (9.4)	17 (53.1)	32
27–28	114 (45.1)	77 (30.4)	62 (24.5)	253
29–30	356 (70.5)	91 (18.0)	58 (11.5)	505
31–32	737 (84.2)	98 (11.2)	40 (4.6)	875
33–34	918 (94.8)	37 (3.8)	13 (1.4)	968
>34	185 (96.4)	6 (3.1)	1 (0.5)	192
Total	2322 (82.2)	312 (11.0)	191 (6.8)	2825

infants (4.0%) died before they could be examined, 34 infants (1.1%) died after 1 to 2 examinations, and 33 infants (1.1%) did not complete all follow-up visits. These 189 infants (6.3%) were excluded from the study. Thus, 2825 preterm infants (93.7%) were enrolled in this study.

In the study, 1665 (58.9%) of infants were male, 2201 (77.9%) infants were singletons, and 624 (22.1%) of multiple deliveries. The mean GA at birth of all the infants was 31.7 weeks (range 24–36 weeks), and the mean BW was 1724 g (range 650–3430 g).

Table 1 summarizes the characteristics of the 2825 infants receiving the screening examination. There was a statistically significant difference in BW, GA, and multiple births between infants with and without ROP.

Incidence of ROP

Retinopathy of prematurity was identified in 503 infants (17.8%). One hundred ninety-one infants (6.8%) underwent laser photocoagulation therapy or other treatments (Table 2).

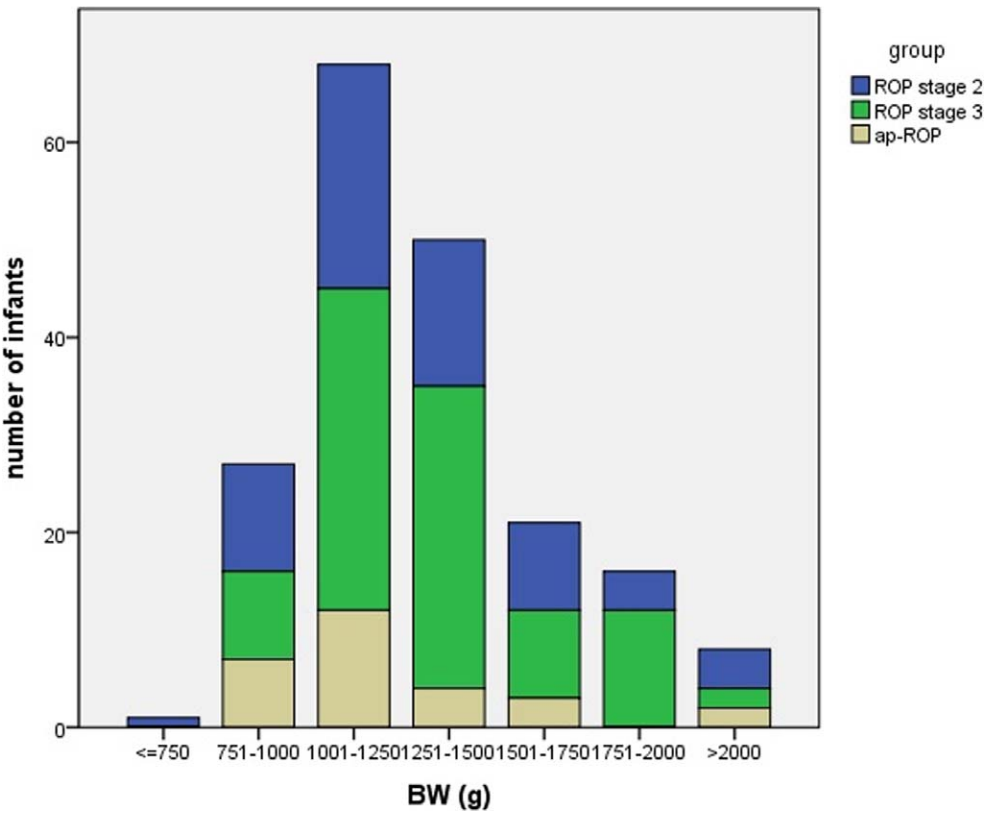

Figure 1. Distribution of infants with severe retinopathy of prematurity according to birth weight.

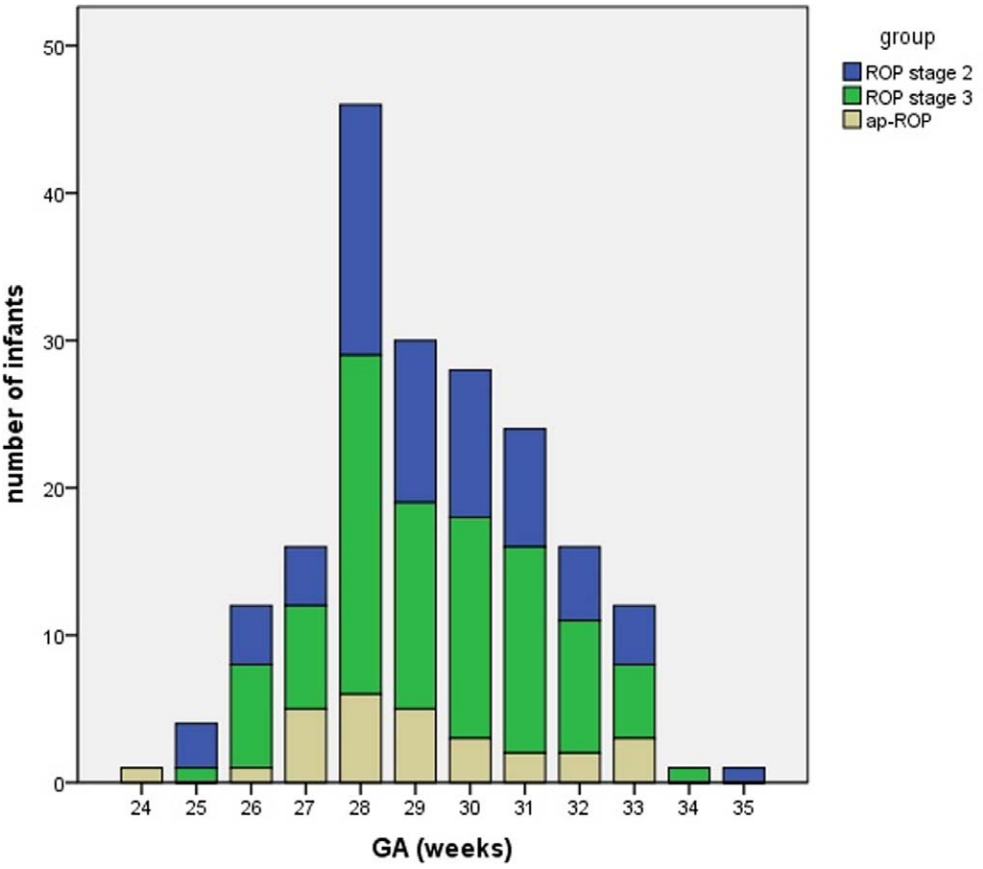

FIGURE 2. Distribution of infants with severe ROP according to GA.

The proportion of infants developing ROP increased with decreasing GA and BW. Very premature infants were more at risk than more mature ones, as 55.8% (159/285) of infants with GA less than or equal to 28 weeks and 26.8% (446/1665) with GA less than or equal to 32 weeks developed ROP. Low BW infants were also more at risk than higher BW infants, as 54.5% (54/99) of infants with BW less than or equal to 1000 g and 37.6% (329/876) of infants with BW less than or equal to 1500 g developed ROP.

The proportion of infants with BW less than or equal to 1000 g and BW less than or equal to 1500 g who developed severe ROP was 28.3% (28/99) and 16.7% (146/876), respectively (Table 3).

In 503 ROP infants, 174 (34.6%) were born with BW heavier than 1500 g, and 45 (25.9%) of them required treatment. Similarly, 130 (25.8%) ROP infants were born at GA older than 32 weeks, and 14 (10.8%) of them needed treatment. The BW of the largest newborn diagnosed with ROP was 3350 g, and the GA of the most mature infants with ROP was 36 weeks.

Infants Needing Treatment

The mean GA and BW of infants requiring treatment were 29.3 weeks (range 24–35) and 1331 g (range 750–2550), respectively. The GA and BW of these infants were significantly lower than the infants with no ROP (mean 32.1 [2.0] weeks, $P < 0.001$; mean 1788 [387] g, $P < 0.001$) and infants with mild ROP (mean 30.2 [2.1] weeks, $P < 0.001$; mean 1483 [374] g, $P < 0.001$).

Among treated infants, 120 (62.8%) were male, and 28 infants (14.7%) developed AP-ROP. Aggressive posterior ROP accounted for larger proportions of cases in the subgroup of BW less than or equal to 1250 g or GA less than or equal to 28 weeks than in the other subgroups (Figs. 1, 2). Even after early, confluent, and adequate laser treatment, 4 of 96 infants (4.2%) with stage 3 plus disease and 8 of 28 infants (28.6%) with AP-ROP developed retinal detachment. Among these 12 infants, 12 eyes of 9 infants progressed to stage 4, and 4 eyes of 3 infants progressed to stage 5, and they all received lens sparing vitrectomy.

Applicability of the US and UK Screening Guidelines in the Present Study

Using the current the US screening guidelines, 1749 infants (61.9%) in all would have been excluded from the ROP screening. Of those, 105 infants (33.7%) had mild ROP and 28 infants (14.7%) reached treatment-requiring ROP and would have been missed if the US criteria had been chosen (Fig. 3). One thousand four hundred ninety-six infants (53.0%) had BW and GA exceeding those recommended for screening by the Royal College of Ophthalmologists, the UK. If the UK criteria had been chosen, 84-mild ROP infants (26.9%) and 18-severe ROP infants (9.4%) would have been missed (Fig. 3).

The Effectiveness of the Current ROP Guidelines

To verify whether the criteria for ROP screening in China could be narrowed in the present study, we analyzed the GA and BW of all infants with ROP. The results, as listed in Table 4, showed clearly that more ROP infants would have been missed within the progressively narrower screening range. However, most of them were of mild ROP that did not need treatment. In fact, at

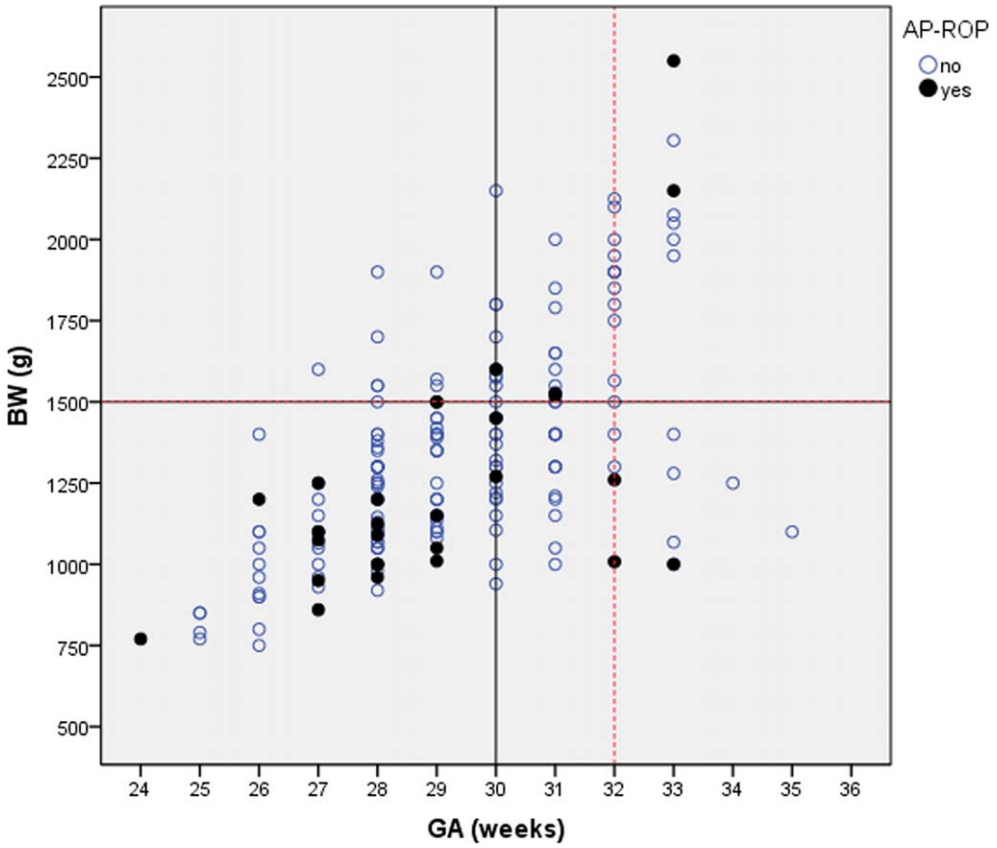

FIGURE 3. Plots of BW versus GA for infants treated for ROP. The *continuous vertical line* at less than or equal to 30 weeks and the *horizontal line* at less than or equal to 1500 g indicate the criteria used in US for ROP screening program. The *red dashed vertical line* at less than 32 weeks and the *horizontal line* at less than 1501 g indicate the UK national ROP screening criteria. The *filled circles* represent infants with AP-ROP, while the *hollow spots* represent infants with treated ROP but no AP-ROP.

GA less than or equal to 33 weeks and/or BW less than or equal to 1750 g, no ROP who required treatment would have been missed in this cohort of patients.

DISCUSSION

Studies suggest that ROP is emerging as a major cause of treatable childhood blindness in middle income countries like China and in many other countries such as those in Latin America, Asia, and Eastern Europe.[3,10] At the beginning of this century, ROP screenings in China were available only in NICUs in developed cities such as Beijing, Shanghai, and Guangzhou. Since the initiation of the ROP screening program by the Ministry of Health of China in 2004, an increasing number of ROP studies were conducted, reporting on the incidence, characteristics, and treatment options of ROP (Table 5). However, most of these results were published in Chinese journals.[12–24] Despite the differences in screening criteria, neonatal treatment, and the use of supplemental oxygen in different NICUs, these data present a clear picture that (1) in developed regions such as Beijing, Shanghai, and Guangdong Province, the rate of ROP was much lower than that in the less developed regions such as Henan Province and Qinghai Province, and (2) the incidence of ROP in China declined from 2000 to 2012, particularly in developed regions after 2004. These changes are most probably associated with the significant improvements in child healthcare in China, including prenatal care, delivery care, and postnatal care, as well as improved general socioeconomic conditions, such as increased household income, educational levels, and government initiatives.[25,26]

The percentage of ROP and severe ROP observed in our study is comparable with the results obtained from other middle income countries.[27–29] In 2004, Trinavarat et al.[27] reported that the incidence of ROP in Thailand was 13.6% and

TABLE 4. Number of Infants With Various Stages of ROP Who Would Have Been Missed, if the Present Screening Criteria Had Been Modified

Screening Criteria	No. of Infants Fulfilling Criteria	No. of Infants Without Screening	No. of Infants Missed With Mild ROP	No. of Infants Missed With Severe ROP
GA ≤33 wk and/or BW ≤2000 g	2583	242	6	0
GA ≤33 wk and/or BW ≤1750 g	2349	476	14	0
GA ≤32 wk and/or BW ≤2000 g	2339	486	12	5
GA ≤32 wk and/or BW ≤1750 g	1931	894	30	7

Table 5. Previous Studies of Retinopathy of Prematurity Incidence in Different Provinces in China

References	Study Type	Province	Patients, y	Criteria	Incidence of ROP	Proportion of Treated ROP
Luo et al.[12]	Multicenter prospective	Guangdong	586 (2009.9–2010.8)	BW <2000 g	10.07%	5.12%
Li et al.[13]	Single-center retrospective	Beijing	2185 (2009.1–2010.12)	GA ≤34 wk or BW ≤2000 g	13.1%	1.7%
Liu et al.[14]	Single-center retrospective	Sichuan	332 (2007.12–2011.3)	GA ≤34 wk or BW ≤2500 g	12.35%	1.51%
Wu et al.[15]	Single-center retrospective	Jilin	336 (2007.1–2008.12)	GA ≤36 wk	22.7%	6.8%
Zhang[16]	Single-center retrospective	Henan	398 (2006.12–2009.10)	GA <37 wk or BW <2500 g	26.4%	2.5%
Ju et al.[17]	Single-center retrospective	Qinghai	240 (2005.7–2008.6)	GA ≤34 wk or BW ≤2000 g	23.3%	5.4%
Jin et al.[18]	Multicenter retrospective	Zhejiang	1225 (2005.3–2008.11)	GA ≤34 wk or BW ≤2000 g	10.8%	1.4%
Zhu et al.[19]	Multicenter retrospective	Shanghai & Jiangsu	621 (2005.1–2005.12)	BW <2000 g	11.8%	3.1%
Beijing ROP study Group[20]	Multicenter retrospective	Beijing	639 (2005.1–2005.12)	GA ≤34 wk or BW ≤2000 g	10.8%	3.6%
Zhang et al.[21]	Multicenter retrospective	Guangdong	1372 (2004.1–2007.1)	BW <2000 g	15.9%	7.5%
Shan et al.[22]	Single-center retrospective	Shanghai	168 (2002.12–2004.4)	GA <37 wk	30.4%	27.1%
Yin et al.[23]	Single-center retrospective	Beijing	98 (2002.7–2003.6)	GA ≤34 wk or BW ≤2000 g	17.3%	4.1%
Huang et al.[24]	Single-center retrospective	Guangdong	108 (2000.3–2004.12)	GA <37 wk or BW ≤2000 g	21.3%	6.5%

6.4% of screened infants developed severe ROP. In 2006, a prospective study conducted in South Africa also showed that ROP was diagnosed in 16.3% infants, and an estimated frequency of severe ROP was more likely to be 2.9%.[28] In 2010, Zin et al.[29] reported a study, including seven neonatal units in Rio de Janeiro found that the incidence of ROP was 16.9% and 3.6% of screened infants needed treatment. The characteristics of infants developing severe ROP and the incidences of treatable ROP vary from developed countries to middle income countries, possibly due to the combined differences in neonatal care, different screening criteria, economic conditions, races, and other risk factors. Compared with data from developed countries, such as the US and Canada,[30,31] the infants who developed severe ROP were bigger and more mature in our study. The quality of neonatal care may be highly relevant to the higher incidence of severe disease in larger infants in China. Similar results have been reported from other middle income countries in Asia and Latin America, such as India and Brazil.[29,32] In developed countries, the development of severe ROP is extremely rare in infants with BW of 1250 g or greater or GA of 31 weeks or greater.[2] With advanced economies and developed neonatal care, only 14.8% (209/1408) and 14.2% (24/169) of extremely low BW infants in the NICUs in the US[33] and Canada[31] were treated.

The higher mean GA and BW in our study reflect the relatively high mortality rate among extremely premature infants in China. For example, in our study only 8 of 415 (1.9%) infants with BW less than 1251 g had BWs of less than 750 g, which contrasts with 26.1% in ETROP.[30] Meanwhile, the proportion of babies GA less or equal to 27 weeks was 20.7% (86/415), also lower than the 47.2% (3305/6998) observed in ETROP.[30] A portion of infants in our initial study died before or during our screening, among which 110 infants were less than 1000 g in BW. Such a relatively high mortality rate in extremely preterm infants in Chinese NICUs was likely reflecting a combined effect of lack of high-quality neonatal care compared with developed countries, and the balance between the costs of care and the family's ability to afford the care.

The reported incidence of ROP varies between countries and even between regions and units, suggesting that caution must be applied in extrapolating conclusions about ROP screening criteria from one population to another. The findings of our study have important implications that, even in tertiary care NICUs in urban areas of China, more mature infants are at risk of developing severe ROP. If the UK or US guidelines had been applied to our subject population, many infants would have missed the opportunity for treatment. This discrepancy is likely due to differences in systems of neonatal healthcare and the population studied. Therefore, the ROP screening criteria in China needs to be wider than the developed countries. However, medical care for neonates in China has improved dramatically over the past decade, as evidenced by the increased survival rate of low BW infants,[34,35] resulting in more infants eligible for ROP screening, which greatly increases the workload of Chinese ophthalmologists.

The objective of ROP screening is to identify all infants who require treatment. The minimum number of infants to be screened without missing any case of concern would constitute an effective guideline. There is a potential for lessening workload by reducing the upper inclusion limits of BW and GA. In our present study, if we used the criteria we recommended, GA less than or equal to 33 weeks and/or BW less than or equal to 1750 g, nearly 500 infants would not have needed examinations. That would reduce the workload by almost 20%, which is especially relevant to China where the population to be screened is large, but screening facilities and ROP expertise are limited. Our results are encouraging for us to modify the current ROP screening protocol, but may not be applicable to other regions in China due to differences in neonatal care and other relevant factors.

Our study has inherent shortfalls, as it was conducted in the NICUs in Shanghai, a major metropolitan city in China, so the incidence and severity of ROP are not representative of those in the entire Chinese population. Further population-based studies on premature infants in the broader community are essential so that the incidence and severity of ROP in China may be assessed comprehensively and definitively.

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