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Incidence of Type-1 Retinopathy of Prematurity in Premature Babies Born Small for Gestational Age

Ekstrem Prematüre Bebeklerde Tip-1 Prematüre Retinopatisi İnsidansı

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Summary

Purpose: To compare the incidence of type retinopathy of prematurity (ROP) in patients small for gestational age (SGA) and in patients appropriate for gestational age (AGA) in a developing country.

Material and Method: We included in this study infants (n=162) with gestational age (GA) ≤34 weeks who were screened for ROP in a neonatal intensive care unit between June 2007 and December 2011 and were followed up until the retina was completely vascularized or ROP was regressed. Type 1 ROP was defined according to the ETROP study. To describe the incidence of type 1 ROP, data were analyzed in two main groups: (A) SGA-group and (B) AGA-group. SGA was defined as birth weight below the 10th percentile for gestational age. GA in weeks, birth weight (BW) in grams (g), ROP at any stage, type 1 ROP, and post menstrual age (PMA) at type 1 ROP were evaluated for the two groups. Retrospective review of records was performed.

Results: BW (in mean±SD) was 832.45±131.74 g in group A and 962.97±351.47 g in group B; GA (in mean±SD) was 29.27±2.4 weeks in group A and 27.36±2.8 weeks in group B, with significant difference between the groups (p=0.001 vs. p<0.0001). Overall incidence of any-stage ROP was 41.2% in group A and 45.9% in group B, while type 1 ROP was 17.6% in group A and 15.3% in group B. PMA at type 1 ROP detection was 35±3.6 weeks in group A and 33.83±2.7 weeks in group B, without significant difference (p=0.57 vs. 0.44 vs. 0.23). In group A, the earliest diagnosis of type 1 ROP was 31 weeks PMA, the latest diagnosis was 43 weeks PMA. In group B, the earliest diagnosis of type 1 ROP was 32 weeks PMA, the latest diagnosis was 42 weeks PMA.

Discussion: In groups A and B, larger infants may develop type 1 ROP and require treatment. Overall incidence of type 1 ROP in groups A and B is without significant difference. *(Turk J Ophthalmol 2013; 43: 340-4)*

Key Words: Small for gestational age, appropriate for gestational age, retinopathy of prematurity, type-1-ROP, developing country

Özet

Amaç: Ekstrem prematüre bebeklerde ve yaşına göre uygun prematüre bebeklerde gelişmekte olan ülkede tip-1 prematüre retinopatisi (PR) insidansını incelemek.

Gereç ve Yöntem: Haziran 2007-Aralık 2011 tarihleri arasında Yenidoğan Yoğunbakım Unitesinde ≤34 gestasyonel haftanın altında olup, retinal vaskularizasyonu tamamlana dek veya PR si regrese olana dek takip edilen bebekler (n=162) calışmaya dahil edildi.Tip-1-PR ETROP kriterlerine gore belirlendi. Tip-1-PR insidansı iki grupta incelendi: grup-A: ekstrem premature bebek; grup-B: yaşına uygun premature bebek. Doğum ağrlığının 10 persentilin altında olması kucuk premature bebek kriteri olarak kabul edildi. Her grupta gestasyonel yaş (GY), doğum ağırlığı (DA), herhangi bir evre PR oluşumu, tip-1-PR oluşumu, tip-1-PR oluşumunda postmenstruel hafta (PMH) incelendi. Dosyalar retrospektif tarandı.

Sonuçlar: DA ve DH ortalama± grup-A da 832,45±131,74 gram, -B de 962,97±351,47gram ve 29,27±2,4 hafta ve 27,36±2,8 hafta idi. Gruplar arasında anlamlı fark bulundu (p=0,001 vs p<0,0001). Herhangi bir evre PR insidansı grup-A da %41, -B %45, tip-1 PR insidansı grup-A da %17, -B de %15. Tip-1-PR oluşumunda PMH grup-A 35±3,6 hafta, -B de 33,83±2,7 hafta idi ve gruplar arasında fark görülmedi (p=0.57 vs 0,44 vs 0,23). Grup-A da tip-1-PR tanısı en erken 31. PMH da, en geç 43. PMH da kondu. Grup-B de tip-1-PR tanısı en erken 32. PMH, en geç 42 PMH da kondu.

Tartışma: Gelişmekte olan ülkede grup-A ve –B de büyük prematüre bebeklerde mutlak tedavi gerektiren tip-1-PR oluşmaktadır. Grup-A ve -B de tip-1-PR insidansı istatistiksel farklılık göstermemektedir. *(Turk J Ophthalmol 2013; 43: 340-4)*

Anahtar Kelimeler: Ekstrem prematüre bebek, yaşına uygun prematüre bebek, prematüre retinopatisi, tip-1-PR, gelişmekte olan ülke

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Introduction

Retinopathy of prematurity (ROP) is a neovascular eye disease that affects the developing retina in premature infants and is a leading cause of preventable childhood blindness in developed and developing countries.[1] The proportion of blindness as a result of ROP varies greatly among countries, being influenced both by levels of neonatal care (in terms of availability, access, and neonatal outcomes) and by the availability of effective screening and treatment programs.[2] The World Health Organization's 'Vision 2020 programme'1 has identified ROP as an important cause of preventable childhood blindness in both high and middle income countries.[3]

In highly developed, industrialized countries (i.e., those ranked highly by the United Nations Development Programme (UNDP) on the basis of their Human Development Index), the population of premature infants who are currently at risk for the advanced stages of ROP that requires treatment is extremely premature, with birth weights almost always <1000 g.[4,5] In 2006, ROP guidelines were modified to increase the GA for screening from 28 weeks or less to 30 weeks or less.[6,7] But most infants who developed type 1 ROP in the cohort of Wu C et al. WINROP consortium were born at 28 weeks or less GA.[8] Several studies suggest that larger, more mature infants are developing severe ROP in countries with low/moderate levels of development compared with highly developed countries with require of broadened screening guidelines in developing countries.[9-12]

In the present study, we investigated the incidence of type 1 ROP in SGA and in AGA in a cohort of premature infants in a developing country.

Materials and Methods

The Institutional Review Board approved the study (KA09/388). Medical charts of premature infants, who were screened for ROP at the Neonatal Intensive Care Unit (NICU) of Baskent University, Faculty of Medicine between June 2007 and December 2011, were retrospectively reviewed.

Examinations for ROP were performed by qualified ophthalmologist with expertise in ROP (AI). All the infants were examined according to standard ROP protocol consisting of a dilated funduscopic examination using binocular indirect ophthalmoscopy with scleral depression. The first examination was performed for all premature infants below 30 weeks GA or less than1500 g BW by 31-week postmenstrual age (PMA) (gestational age + day after birth) or by 4-6 weeks chronologic age, and additional examinations were repeated until the retina was completely vascularized or until criteria for treatment were met.7 Additionally, due to the fact that findings suggest that larger, more mature infants are developing severe ROP in countries with low/moderate levels of development compared with highly developed countries, we included infants ≤34 estimated gestational weeks in our screening for ROP.[9] Classification of ROP was performed according to the International Classification of Retinopathy of Prematurity. The highest stage and lowest zone of ROP, presence of prethreshold or threshold disease, and need for ROP treatment were recorded. Prethreshold ROP was further subclassified according to Early Treatment for Retinopathy of Prematurity criteria (ETROP) into type 1 and type 2 ROP.[4,13] Type 1 ROP was defined according to the ETROP study: zone 1, stage 3, without plus disease; zone 1, any-stage ROP, with plus disease; zone II, stage 2 or 3, with plus disease. All infants with ROP requiring treatment were defined as having onset of type 1 ROP as in the ETROP study.

All infants with an estimated gestational age of 34 weeks and less, with follow-up until the retina was completely vascularized or ROP was regressed were included in this study. Infants transferred to a neonatal unit outwith, discharged home or failed to attend outpatient eyes screening before retina was completely vascularized or ROP was regressed, infants with insufficient medical records, and infants with hydrocephalus or excessive edema on physical examination were excluded.

Patient Groups

To determine the incidence of type 1 ROP, we analyzed the data in two main groups: (A) SGA-group and (B) AGA-group. SGA was defined as birth weight below the 10th percentile for gestational age.[14,15] The following data were collected in each group: GA in weeks at birth, BW in g, identification of infants developing any-stage ROP, developing type 1 ROP, and PMA at type 1 ROP detection. Birth weight, GA, incidence of any-stage ROP and type 1 ROP were analyzed in groups A and B and compared between the groups.

The Cohort in This Study was Ethnically Homogenous.

Based on the ETROP study criteria, standard treatment with laser photocoagulation was performed if ROP became severe enough to warrant treatment at type 1 ROP.[4]

Statistical analyses were performed using IBM® SPSS® Statistics 19.0 (SPSS Inc., Chicago, IL, USA). T-test and chi-square test were used to determine the significance of difference between the groups or to compare the groups. P-value <0.05 was considered statistically significant.

Results

In our cohort, overall 367 premature infants were examined. 162 premature infants met the inclusion criteria and were analyzed in the study. The mean±SD (standard deviation) BW and GA of infants, the number of infants with any-stage ROP, type 1 ROP, and PMA in mean±SD at type 1 ROP detection in the two groups are presented in Table 1.

Any-stage ROP

In group-A, the BW (in mean±SD) of infants with any-stage ROP (n=21) was 809.8±164.2 g (min-max 495-1010 g) and GA (in mean±SD) was 29.71±2.8 weeks (min-max 25-34 weeks). In group-B (n=51), the BW of infants with any-stage ROP was in mean±SD 822±158.5 g (min-max 570-1100 g) and GA was in mean±SD 26.4±2.2 weeks (min-max 24-33 weeks). We compared BW and GA between the two groups and found no signifcant difference concernig BW (p=0.75), but for GA

Table 1. Results of ROP screening of babies, who where in SGA-Group=Group A and AGA Group=Group B; n=number of patients; BW=Birth weight; GA=gestational age; PMA= Post menstrual age; ∞=t-test; ğ=chi-square test; P < 0.05 was considered statistically significant

	Group A	Group B	P
Patients (n)	51	111	
BW (gram), min-max	495-1010	500-2250	
BW mean±SD	832.45±131.74	962.97±351.47	0.001∞
GA (weeks), min-max	24-34	24-34	
GA mean±SD	29.27±2.4	27.36±2.8	< 0.0001∞
Any-stage ROP n/%	21/41.2%	51/ 45.9%	0.57ğ
Type 1 ROP n/%	9/17.6%	17/15.3%	0.44ğ
PMA (min-max, weeks) at Type 1 ROP detection	31-43	32-42	
PMA (mean±SD, weeks) at Type 1 ROP detection	35±3.6	33.83±2.7	0.23∞

(p=0.0001). There was no difference in any-stage ROP incidence between groups A and B (p=0.57).

Type 1 ROP

In group A, the BW of infants with type 1 ROP (n=9) was in mean±SD 799±191.3 g (min-max 495-990 gr) and GA was in mean±SD 28.11±1.8 weeks (min-max 25-30 weeks). In group B, the BW of infants with type 1 ROP (n=17) was in mean±SD 830±197.2 g (min-max 630-1410 g) and GA was in mean±SD 26.05±2.3 weeks (min-max 24-33 weeks). We compared BW and GA between the two groups and found no significant difference for BW (p=0.70), but for GA (p=0.029). There was no difference in type 1 ROP incidence between groups A and B (p=0.44).

PMA at Type 1 ROP Detection in Group A and Group B

Regarding PMA in weeks, at type 1 ROP detection, we did not detected any significant difference between the two groups (p=0.23).

The earliest diagnosis of type 1 ROP was 31 weeks PMA in group A (BW: 495 g; GA 26 weeks). The latest diagnosis of type 1 ROP was 43 weeks PMA also in group A (BW: 940 g, GA 31 weeks).

The greatest BW of premature infant, who developed type 1 ROP was 1410 g with GA of 33 weeks and development of type 1ROP in PMA of 42 weeks in group B.

Because of using ETROP criteria for treatment, there was no difference in the timing of laser treatment. All treated eyes had in the follow-up a favourable outcome, but one treated eye in group A infant (BW 900g, GA 30, PMA of type 1 ROP detection: 36 weeks) progressed after laser photocoagulation to stage IV ROP with retinal traction in the temporal retina. After 3-port lens-sparing vitrectomy, anatomical success was achieved.

Discussion

Retinopathy of prematurity is caused by abnormal postnatal retinal development. Low serum IGF-1 levels and poor postnatal weight gain are associated with the development of severe ROP in clinical and animal studies.[16-19] The WINROP algorithm uses both factors to identify infants who are at high risk for developing severe ROP and is able to identify all children (100% sensitivity) who were diagnosed with severe ROP.[16] In our study, we analyzed SGA and AGA groups of premature infants. In our cohort, we retrospectively investigated the incidence of any-stage ROP, type 1ROP and PMA at type 1 ROP in SGA-(group A) and AGA (group B) infants. Variations in ROP incidence have been previously reported.[19] GA of our study groups differed between 24-34 weeks. The incidence of any-stage ROP for comparable GA differed between 46.2% and 100%.[18,20-24] In the ETROP study, the incidence of any-stage ROP in infants with GA <27 was 89%. Most reports from western centers and developed countries focus on ROP in extremely premature infants with <1250 g BW and GA <27 weeks.25 The mean BW of infants in ETROP cohort was 703 g, GA 25 weeks. The mean BW and GA of SGA-infants in groups A and B in the present study were in mean 832.45 g and 29.27 weeks vs. 962.97 g and 27.36 weeks, which are much higher than in the ETROP cohort (4). In group A, our results of any-stage ROP incidence of 41.2% is comparable with the population of middle-income countries with 43% of any-stage ROP incidence.[26] Our results of the AGA-group concerning the incidence of any-stage ROP (45.9%) are similar to Filho et al.'s study with 43-23.3%.27 Similar almost higher results for any-stage ROP incidence as in our study are given to be 56.2% by Basmak et al.[12] Concerning the incidence of any-stage ROP, in line with previous investigations, the results in the present study in the SGA-group as well as in the AGA group were comparable with the results for developed countries.[12, 26, 27]

In group A, the incidence for type 1 ROP of 17.6% was comparable with the results of Filho et al. of 14%, which are higher than Teed et al.'s results of 9% but lower than the results of Kumar et al. with 28.2%.[21,22,26,27] In group B, the incidence of type 1 ROP was 15.3% and was similar to the results reported by Kumar et al. (14.4%) but lower than the results reported by Isaza et al. or Teed et al. (23% vs. 24.4%).[21,22,26] Results after using WINROP algorithm - severe ROP developed in 8.8%, with requiring treatment in 4.1%. In the WINROP cohort, the median GA of the infants at birth was 25 weeks (range, 23-30 weeks), and the median BW was 770 g (range, 450-850 g).20 In our study, we also used the screening guidelines as in WINROP group.6 Additionally, due to the fact that findings

suggest that larger, more mature infants are developing severe ROP in countries with low/moderate levels of development compared with highly developed countries, we included infants ≤ 34 estimated gestational weeks in our screening for ROP.[9] In our cohort, the range for BW in group A was 495-1010 g and for GA - 24-34 weeks. In group B, the range for BW was 500-2250g and for GA - 24-34 weeks. In our cohort, we used ETROP criteria for treatment and there was no difference in the timing of laser treatment. The earliest diagnosis of type 1 ROP was 31 weeks PMA in Group A (BW: 495 g; GA 26 weeks), the latest diagnosis of type 1 ROP was 43 weeks PMA (BW: 940 g, GA 31 weeks) also in group A. In groups A and B, type 1 ROP incidence was 17.6% vs. 15.3% with no difference between the groups. An incidence of type 1 ROP with 17.6% vs. 15.3% in our cohort is much higher than the severe ROP incidence with 8.8% in the WINROP group.

It has been well documented that babies born SGA have an increased risk of developing severe ROP and this is confirmed in our small series, with 17.6% of the SGA babies requiring treatment for ROP comparable with 18.2% of other studies.[28-31]

In our study, the PMA for the onset of type 1 ROP was in SGA infants in mean 35.3±3.6 (min-max 31-43) weeks and in AGA-infants in 33.8±2.6 (min-max 32-42) weeks. There was no significant difference between groups A and B concerning PMA at type 1 onset (p=0.23). The overall mean PMA at type 1 ROP onset of 35.3 vs. 33.8 weeks in mean found in this study is similar to median PMA prethreshold ROP onset of 36.1 weeks in the ETROP study. The mean PMA for onset of type 1 ROP at[32] weeks PMA in SGA infants was reported by Misra et al.[31] Reynolds et al. reported the mean PMA of onset of type 1 ROP in all patients and in each individual study group within the window between 30.9-45 weeks for the development of prethreshold or worse ROP.[5] In developed countries, termination of acute phase ROP screening can occur when the risk for developing serious ROP has passed. As already stated, prethreshold ROP precedes the development of threshold ROP, and 99% of prethreshold ROP has developed by 45 weeks' PMA for the nursery populations studied herein. Thus, acute phase ROP screening can conclude by at least 45 weeks' PMA as long as prethreshold or worse acute ROP is not present. This value is an extreme and is based only on age rather than on retinal findings. It is far more likely that the child's ROP will progress to serious ROP at an earlier age or that retinal maturity or ROP regression will occur earlier than 45 weeks' PMA. Typically, ROP regression begins by 39 weeks' PMA, and 90% of cases show involution by 44 weeks' PMA.[32,33] In our study, the window for PMA of onset of type 1 ROP for SGA and AGA groups was between 31-43 weeks. According to expectation, the earliest PMA of 31 weeks (BW: 495 g; GA: 26 weeks) was in group A of SGA infants, but unexpected, the latest PMA of 43 weeks also in SGA infant collective. Furthermore, in group B infants, the latest PMA of onset of type 1 ROP was 42 weeks of premature infant with GA of 33 and BW of 1410 g. These results indicate, that in developing countries, infants of higher GA and BW may also be affected from severe ROP requiring treatment.[9-12,34]

In conclusion, concerning incidence of any-stage ROP, we can say that in the present study population, the incidence of any-stage ROP is in SGA-group as well as in AGA group, in children >30 weeks, remarkably higher than in western countries. In our cohort, the results suggest that in SGA- and AGA-infant groups, more larger and mature infants may develop type 1 ROP with no difference between the groups and require treatment. Screening protocols covering more mature infants can be designed especially for countries with low/moderate levels of development after extended analyses.

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