

## Original Article



# Can 5-minute Apgar score be considered as an additional independent risk factor for screening of retinopathy of prematurity?

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## Abstract

**Introduction:** Because of increasing the population of premature infants due to improving neonatal care we try to find other independent criteria in addition to birth weight and gestational age to reduce the number of infants who need a retinopathy of prematurity (ROP) screening examination.

**Methods:** This is a retrospective cross-sectional study, included 150 preterm infants with gestational age of  $\leq 32$  weeks or birth weight  $\leq 1500$  g or receives oxygen therapy for more than 2 days, who were examined from the fourth week of life for ROP in Tabriz Al-Zahra hospital's neonatal intensive care unit (NICU), from March 2017 to January 2018. All infants with other risk factors such as multi gestational pregnancy, blood transfusion or exchange, phototherapy, underlying disease, cerebral hemorrhage, chronic lung disease and sepsis were excluded from the study. Infants divided to two group ROP ( $n=47$ ) and non-ROP ( $n=133$ ) and their 5-minute Apgar score was compared as an independent risk factor. Exploratory data analysis was performed using descriptive measures with independent samples t tests. Kolmogorov-Smirnov tests were used to test the normality of data distribution.

**Results:** The mean 5-minute Apgar scores were statistically lower in ROP group ( $5.4 \pm 2.3$ ) than non-ROP group ( $6.2 \pm 2.1$ ) ( $P$  value=0.041).

**Conclusion:** Apgar score was statistically significant, but in light of the very close results obtained, it seems prudent to consider an independent risk factor.

## Introduction

Retinopathy of prematurity (ROP) is a multifactorial disorder with vasoproliferative nature that affecting premature neonates with low birth weight (LBW) and very low birth weight (VLBW). ROP is considered the main cause of preventable but untreatable blindness in children throughout the world.<sup>1-4</sup>

Many risk factors can lead to the development of ROP; their leaders are gestational age and birth weight. Other factors described in the articles are oxygen therapy, male gender, apnea, sepsis, cerebral hemorrhages and anemia. The role of these risk factors has not yet been fully elucidated. Instead, preeclampsia and respiratory system maturation due to prenatal steroids therapy have been shown to have a protective role.<sup>5-9</sup>

Since the survival rate of premature infants' increases, recent articles have shown a significant decrease in the incidence of ROP, which is possible to improved neonatal

care and better determining the causes of ROP.

Identifying other effective risk factors and prognostic factors which can be easily evaluated can reduce the number of unnecessary examinations.

Because we observed cases of ROP in routine examinations of neonates who had no risk factor for screening we concluded that other measurable risk factors other than gestational age and weight should be considered for screening. Perhaps the first measurable risk factor that predicts the probability of oxygen therapy is the Apgar score. Our first objective in this study was to determine whether the Apgar score is an independent risk factor or not and in the following of this study, what score can be considered as a risk factor.

## Methods

This retrospective cross-sectional study was performed from March 2017 to January 2018. The study population

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consisted of newborns admitted to the neonatal intensive care unit (NICU) at Al-Zahra hospital of Tabriz. For the cases of gestational age  $\leq 32$  weeks or birth weight  $\leq 1500$  g or receive oxygen therapy for more than 2 days, then screening for ROP started between 4 and 6 weeks after birth and re-examined from 7 to 14 days according to the fundus exam until complete vascularization of the retina was obtained also treatment was performed in all cases with type 1 ROP.

A single drop of tropicamide (1%) and phenylephrine (2.5 mg/mL) was instilled into each eye to obtain full mydriasis 1 hour and 30 minutes before starting examination. An ROP expert investigator examined the fundus using a Topcon indirect ophthalmoscope and a VOLK Pan Retinal 2.2D lens in NICU of Alzahra hospital or Nikukary eye center if permission from NICU. If retinal vascularization was completed without any stage of ROP, then the infant was registered to the non-ROP group. Upon the witness of any stage of ROP, the infant was registered to ROP group.

These parameters were examined and recorded: gestational age, gender, birth weight, duration and method of treatment with oxygen, Apgar score at 5 minute. All infants with the following characteristics were excluded from the study: multi gestational pregnancy, blood transfusion or exchange, phototherapy, underlying disease, cerebral hemorrhage, hypothermia, chronic lung disease, sepsis, jaundice, pulmonary hemorrhage and pneumothorax also infants who did not receive regular follow-up until complete retinal vascularization.

SPSS, version 23 was used for statistical analysis. Descriptive statistics were performed with independent samples t tests and Kolmogorov-Smirnov tests were used to assess the normality of data distribution. The coefficient level of this study was 0.95 and a difference with  $P < 0.05$  was considered statistically significant.

## Results

One hundred and sixty-five neonates have inclusion criteria but 15 infants excluded because their families change their location. Finally, 150 neonates were included in the study. 47 infants (31.3%) developed ROP in their examination and 103 infants (68.7%) never developed any stage of ROP. The mean gestational ages in the ROP and non-ROP groups were  $27.83 \pm 1.70$  weeks and  $29.07 \pm 1.55$  weeks, respectively ( $P$  value  $< 0.001$ ). The mean birth weight in the ROP and non-ROP groups were  $1180.53 \pm 495.12$  g and  $1079.45 \pm 190.45$  grams, respectively ( $P$  value = 0.64) and the mean Apgar scores were  $5.4 \pm 2.3$  in ROP group and  $6.2 \pm 2.1$  in non-ROP group, respectively ( $P$  value = 0.041) (Table 1).

## Discussion

Gestational age and birth weight are traditionally considered the main risk factors for development of ROP; they used as screening criteria all over the world.

**Table 1.** Neonatal Characteristics of ROP and Non-ROP groups.

	Non-ROP (n=103)	ROP (n=47)	P value
Age	29.54 $\pm$ 5.73	30.79 $\pm$ 5.32	0.209
Birth weight (g)	1079.45 $\pm$ 190.45	1180.53 $\pm$ 495.70	0.641
Gestational age (wk)	29.07 $\pm$ 1.55	27.83 $\pm$ 1.70	<0.001
Duration of oxygen therapy (day)	3.22 $\pm$ 2.62	5.78 $\pm$ 3.57	0.022
Apgar score	6.19 $\pm$ 2.04	5.43 $\pm$ 2.28	0.041

recommend criteria for ROP screening were; infants with a birth weight of  $\leq 1500$  g or gestational age of  $\leq 30$  weeks and with a birth weight of 1500–2000 grams or gestational age of  $> 30$  weeks with an unstable clinical course.<sup>10</sup>

It must be consider that these criteria vary in different countries depending on socioeconomic conditions, such as in our country (I.R. Iran) these limits are birth weight  $\leq 2000$  g and gestational age  $\leq 34$  weeks for screening of ROP.

Saving of more immature born neonates leads to increases the population of infants in need of ophthalmological screening, thus use other criteria can reduce inessential aggressive fundus examinations of low risk infants and consequently economical savings occur.

In a study of 957 infants in 2011, Ke et al also found the low Apgar score at 5 minutes was an effective risk factor for the ROP progression to stages requiring treatment. But they could not prove it as an independent factor.<sup>11</sup>

Abrishami et al, in a study in Mashhad with 122 cases founded that Apgar score in ROP cases were lower than newborns without ROP but their study was multifactorial and they not isolated Apgar score as independent factor.<sup>12</sup>

Another study done with Marinov et al in Bulgaria, they shown A low 5-minute Apgar score and an Apgar score of six or less at 5 minutes were not statistically significant risk factors for increasing the incidence of ROP, but were significant risk factor for the progression of low stage ROP to stages requiring treatment.<sup>13</sup>

Yang et al who conducted a retrospective study of 252 (VLBW) children (birth weight  $< 1500$  g) found that low 5-minute Apgar score was an important risk factor for development of ROP requiring treatment.<sup>14</sup>

Our study shown that 5-minute Apgar score was statistically an independent risk factor for the incidence of ROP but given the very statistically close results, it may not be very strong criteria for screening of ROP but it is a good predictor for progression to ROP.

Our study has shortcomings that need further studies to complete; we input any stage of ROP in case group but due to results it seems best to evaluate the different stage of ROP separately. Also in our study gestational age  $\leq 32$  weeks was a risk factor for ROP but in infants with birth weight  $\leq 1500$  g, birth weight not considered as a risk factor for ROP.

### Conclusion

Today, due to the great advances in the field of NICU and neonatology care, more (VLBW) and extremely low birth weight infants survive so that the infants that need ROP screening are increasing and we should find additional criteria for decreasing the population of whom needs screening our study shown Apgar 5 score is risk factor for ROP but statically not a strong criteria for reducing screening population.

### Conflict of Interest

There is no conflict of interest.

### Ethic approval

This research was approved by regional ethic committee of Tabriz University of medical sciences(IR.TBZMED. REC.1397.959)

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### Authors' Contribution

A.E.M. carried out the design and coordinated the study, participated in fundus exams. M.R.N. participated in neonate's examinations and follow ups. A.K. provide assistance in the design of the study, neonate's examinations and follow ups. H.S. provided assistance in statistical analysis and manuscript preparation. A.M.F and Z.A. assisted in data gathering and participated in manuscript editing.

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