

Early Postnatal Prediction of Retinopathy of Prematurity in Preterm Newborns in Neonatal Intensive Care Units

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Abstract

Retinopathy of Prematurity is an issue of the preterm infant portrayed by neurovascular interruption in the juvenile retina that may cause visual hindrance and visual deficiency. This examination planned to build up a screening device for early postnatal forecast of Retinopathy of Prematurity (ROP) in preterm infants dependent on danger factors inside the principal 48h of postnatal life. This examination was led on 200 preterm children admitted to NICU, Benha college Hospital and Nasser General Hospital in Shobra. All children were exposed to full history taking and complete clinical assessment. Fundus assessment by roundabout ophthalmoscope and computerized imaging of chosen cases were finished. There was critical factual increment of ROP among lower GA and BW ($P<0.001$). There was critical measurable increment of ROP in prematures with maternal history of chorioamnionitis and antenatal steroids administration ($P<0.001$). There was huge factual increment of ROP among youngsters with sepsis ($P<0.001$). The frequency of ROP in our investigation was 4.5%. Both birth weight at cutoff point <1.5 Kg and gestational age at cutoff point <33.5 wks had high affectability and particularity in expectation of ROP.

Keywords: Early, Neonatal Intensive Care Units, Postnatal, Prediction, Preterm Newborns.

1. Introduction

Retinopathy of rashness (ROP) is an issue of the preterm infant that can prompt visual impedance and visual deficiency [1].

The retina and retinal vasculature create during incubation, connecting the degree of retinal youthfulness to the degree of rashness of the baby. Therefore, very preterm babies are more helpless to ROP than moderate to late term newborn children [2].

The pathogenesis of ROP includes 2 particular postnatal stages and conceivably pre-stage including stressors inside the intrauterine climate. Presentation to perinatal disease, irritation, and oxidative pressure may impact the postnatal retinal neovascularization measure [3].

Conspicuous danger factors for ROP incorporate low birth weight, low gestational age, and introduction to supplemental oxygen during the initial not many weeks after birth [4].

Other potential antenatal and postnatal danger factors incorporate chorioamnionitis, toxemia, placental disease, sepsis, the presence of patent ductus arteriosus, the utilization of surfactant and bondings, poor postnatal weight gain, and hereditary variables [5].

The occurrence of ROP shifts broadly across various nations and is connected to the financial advancements just as the quality and availability of medical care offices. In the low and center pay nations, a pandemic of ROP visual impairment is presently going on [6].

We expected to build up a screening device for early postnatal expectation of ROP in preterm infants dependent on danger factors inside the primary 48h of postnatal life.

2. Patients and methods

This study was conducted on 200 preterm neonates admitted to NICU of Benha university Hospital and Nasser General Hospital in Shobra,

Ethical committee

Approval of the study protocol by ethical scientific committee was obtained and informed consent was obtained from the parents before enrollment in the study.

Inclusion criteria

Preterm patients less than 35w gestational age and exposed to any risk factors, as antenatal and postnatal risk factors (chorioamnionitis, preeclampsia, placental infection, exposure to supplemental oxygen during the first few weeks after birth, the presence of patent ductus arteriosus, the use of surfactant, transfusion, sepsis, poor postnatal weight gain and genetic factors .

Exclusion criteria

Preterm patients with major congenital anomalies

All neonates were subjected to the following:

Full history taking and complete clinical examination. Complete blood count, CRP, Bleeding profile, Liver function, renal function were done. Fundus examination by indirect ophthalmoscope, and digital imaging of selected cases were done.

Methods

- Complete blood count (CBC): using automated cell counter Samples: 1ml sample of blood is collected by venipuncture or through a central catheter, drawing the blood into a tube containing an anticoagulant (EDTA) to stop its natural clotting. Differential count, and immature to total leukocyte ratio (I: T) for the diagnosis of neonatal sepsis .

- Quantitative CRP assay: Sample: 2ml on plain tube. This test is done using the diagnostic kit for in vitro detection of CRP in human serum by the rapid slide latex agglutination qualitative method.
- Hepatic and renal function: tests by cx9 beckman coulter auto analyzer .
- Methods of retinal assessment: Indirect ophthalmoscopy :Indirect techniques for ophthalmoscopy utilize a gathering focal point to shape an upset and horizontally switched picture which the optometrist at that point sees. The principle favorable circumstances of aberrant frameworks is Stereopsis and enormous field of view making changes in shading and height simpler to distinguish. The light is additionally more brilliant than direct creation seeing through media opacities simpler. The head set roundabout is a significant procedure for infants and youngsters and, contingent upon the intensity of the gathering focal point utilized may give between 45°to 60°field of view. This procedure should be utilized before direct to acquire a general view or impression of the retina with a + 20 D focal point giving a trade off as to amplification and field of view. It is important to widen the student with an enemy of muscarinic .The amplification of the picture is x 0.7 and when this is seen through the cut light with a x 20 amplification, at that point a comparable amplification to that of direct is gotten yet with the additional preferences of good enlightenment, stereopsis and wide field of view. The utilization of a mydriatic is ideal despite the fact that with a normally enormous student; a 3-D perspective on the plate can be once in a while acquired without enlarging. Retinal examination:%Under general anesthesia.100 % no requirement for general sedation .Pre fundus assessment, all infants require to widen understudy utilized cyclophrin eye drop ¾ times 5 minutes span .Indirect ophthalmoscope used to concentrate with 20D lense. Information was gotten by: Area of non vascularized retina.Optic plate changes .Retinal vasculature as respect, size and zone of end .Macular bend. Timing:After release from NICU, so we found that just .

Table (1) Demographic and Clinical data of the studied groups.

Variables	ROP N=9		No ROP n=191		Total No=200		Test of Significance	P value
	No	%	No	%	No	%		
Gender								
Male	3	33.3	77	40.3	80	40.0	X ² = 0.175	0.676
Female	6	66.7	114	59.7	120	60.0		
Gestational age								
32weeks	3	33.3	1	0.5	4	2.0	X ² = 64.411	<0.001
33 weeks	6	66.7	33	17.3	39	19.5		
34 weeks	0	0	79	41.4	79	39.5		
35 weeks	0	0	78	40.8	78	39.0		
Table (1) Continue								
Birth weight (KG)								

Statistical analysis

After data collection, data was revised, coded and fed to statistical software IBM SPSS (statistical package for the social science software) statistical package version 21. All statistical analysis was done using two tailed tests and alpha error of 0.05. The Probability (P-Value) statistical analysis was done at level of significance of $P \leq 0.05$. The following statistical tests were used: Shape of distribution for numeric data:Testing the shape of distribution was done using Kolmogorov-Smirnov Test. All data was normally distributed. Descriptive Statistics: Count and Percentage: Used for describing and summarizing categorical data .Interquartile range, Arithmetic mean and Standard deviation: They are used as measures of central tendency and dispersion respectively for normally distributed numeric data. Analytical Statistics: Categorical Data: Pearson`s chi square test: It is non parametric statistic that is used to test for the association (or relationship) between the categories of two independent samples (row and column variables). Sensitivity, specificity, positive predictive value, negative predictive value and Receiver Operating Characteristic curve (ROC Curve) to illustrate the diagnostic ability of a binary classifier system as its discrimination threshold is varied. Numeric Data: Paired t-test: It is used to assess the statistical significance difference between two population means of dependent (paired) samples. Student t test: It is used to assess the statistical significance difference between two population means of independent (unpaired) samples .Graphical Presentation:Graphs were done for visual presentation using IBM SPSS version 21 and Microsoft excel software.

3. Results

Studied neonates were divided to two groups: group 1: Retinopathy of Prematurity (ROP) N=9; and group 2 not had Retinopathy of Prematurity (NO ROP)N=191.

9 babies had abnormal features during examination by indirect ophthalmoscope .According to presence or absence of ROP neonates divided into:7 of them with mild degree (0-3) . 2 with sever degree (4-5).

Mean ± SD	1.244±0.073	1.802±0.237	1.78±0.259	t test = 7.049	<0.001
Median	1.3	1.80	1.80		
I.Q.R	1.2 – 1.3	1.70 – 2.00	1.6 – 2.0		
Head circumference (cm)					
Mean ± SD	31.89±0.928	31.82±0.823	31.82±0.825	t test = 0.229	0.824
Median	32.0	32.00	32.0		
I.Q.R	31.5 – 32.0	31.0 – 32.0	31.0-32.0		
Temperature within 1 hour					
Mean ± SD	36.856±0.181	36.891±0.19	36.89±0.19	t test = 0.540	0.590
Median	36.8	37.00	37.0		
I.Q.R	36.7 – 37.05	36.7 – 37.0	36.7-37.0		

*P < 0.05= significant; Retinopathy of Prematurity (ROP).

In our study There was no statistically significant difference between group 1 and group 2 as regards gender, head circumference, and temperature within 1

hour P=(0.676, 0.824, 0.590) respectively. On the other hand; there was significant statistical increase of ROP among lower GA and BW P<0.001 Table (1).

Table (2) Distribution of maternal history of the studied groups.

Variables	ROP N=9		No ROP n=191		Total No=200		Test of Significance	P value
	No	%	No	%	No	%		
Antenatal magnesium								
No	6	66.7	142	74.3	148	74.0	X ² = 0.263	0.608
Yes	3	33.3	49	25.7	52	26.0		
Maternal hypertension								
No	6	66.7	142	74.3	148	74.0	X ² = 0.263	0.608
Yes	3	33.3	49	25.7	52	26.0		
Chorioamnionitis								
No	0	0	116	60.7	116	58.0	X ² = 13.014	<0.001
Yes	9	100	75	39.3	84	42.0		
Antenatal steroids								
No	9	100	78	40.8	87	43.5	X ² = 12.240	<0.001
Yes	0	0	113	59.2	113	56.5		
Mode of delivery								
Normal	0	0	10	5.2	10	5.0	X ² = 0.496	0.481
Cesarean	9	100	181	94.8	190	95.0		

*P < 0.05= significant. Retinopathy of Prematurity (ROP).

There was no statistically significant difference between group 1 and group 2 as regards antenatal magnesium intake, maternal hypertension, and mode of delivery P=(0.608, 0.608, 0.481) respectively.

But there was significant statistical increase of ROP in mothers with chorioamnionitis and antenatal steroids P<0.001 Table (2).

Table (3) Distribution of risk factors of ROP of the studied groups.

Variables	ROP N=9		No ROP n=191		Total No=200		Test of Significance	P value
	No	%	No	%	No	%		
RDS								
No	6	66.7	142	74.3	148	74.0	X ² = 0.263	0.608
Yes	3	33.3	49	25.7	52	26.0		
Sepsis								
No	0	0	116	60.7	116	58.0	X ² = 13.014	<0.001
Yes	9	100	75	39.3	84	42.0		

Table (3) Continue

O2 need during								0.828
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resuscitation							
No							
Yes	0	0	1	0.5	1	0.5	X ² = 0.047
	9	100	190	99.5	199	99.5	

*P < 0.05= significant; Retinopathy of Prematurity (ROP).

There was no statistically significant difference between group 1 and group 2 as regards RDS, and O2 need during resuscitation

P = (0.608, 0.828). On the other hand, there was significant statistical increase ROP in neonates with sepsis P<0.001 Table (3).

Table (4) Apgar score of the studied groups.

Variable	ROP N=9		No ROP n=191		Total No=200		Test of Significance	P value
	No	%	No	%	No	%		
APGAR.1minute score							X ² = 0.731	0.529
0-3	6	66.7	100	52.4	106	53.0		
4-6	3	33.3	90	47.1	93	46.5		
7-10	0	0.0	1	0.5	1	0.5		
APGAR.1minute							t test = 0.243	0.808
Mean ± SD	3.556±1.130		3.456±1.208		3.46±1.202			
Median	3.00		3.00		3.00			
I.Q.R	3.00 – 5.00		2.0 – 5.0		2.00 – 5.00			
APGAR.5minute score							X ² = 0.454	0.501
0-3	0	0	0	0	0	0.0		
4-6	2	22.2	63	33	65	32.5		
7-10	7	77.8	128	67	135	67.5		
APGAR.5minute score							t test = 0.490	0.625
Mean ± SD	7.000±0.707		7.199±1.206		7.19±1.187			
Median	7.00		7.00		7.00			
I.Q.R	6.5 – 7.5		6.0 – 8.0		6.0 – 8.0			
Test of Significance							Paired t test = - 32.040	
P value							0.000	

*P < 0.05= significant; Retinopathy of Prematurity (ROP).

There was no statistically significant difference between group 1 and group 2 as regard Apgar score P>0.05 Table (4)

Table (5) ROC curve of low birth weight showing best cutoff point of incidence of ROP in the studied groups.

Best cut off point	AUC	Sensitivity	specificity
1.35 Kg	0.970	100%	94.2%

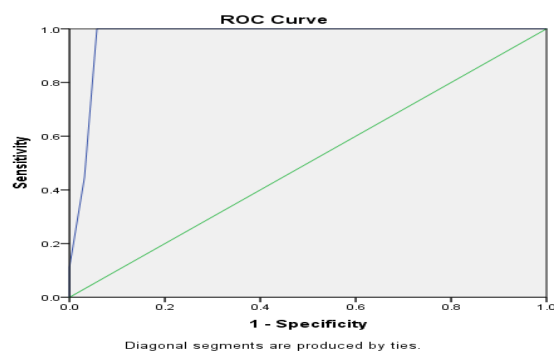


Fig (1) Diagonal segments are produced by ties.

Diagonal segments are produced by ties; ROC curve of low birth weight showing best cutoff point of incidence of ROP in the studied groups at 1.35 Kg; Sensitivity 100%; specificity 94.2% Table (5) and Fig (1).

4. Discussion

Retinopathy of Prematurity (ROP) is one of the most well-known eye problems in untimely newborn children, described by anomalous expansion of retinal veins. On the off chance that untreated, serious ROP can prompt retinal separation and visual deficiency. With the improvement of perinatal medical care, the occurrence of ROP has extraordinarily declined in the created nations. ROP is basically found in untimely babies with a gestational period of <28 weeks and birth weight <1500 g, and the frequency of ROP requiring treatment is low in the created nations [7].

In our study; there was no factually critical contrast between bunch 1 and gathering 2 as respects sex, head periphery, and temperature inside 1 hour. On the other hand; there was huge measurable increment of ROP among lower GA and BW. In concur with, Ghelani et al., [8] who found that sexual orientation was not found as a danger factor for ROP. Hwang et al., [9] revealed that; all newborn children who created ROP in their investigation weighed <1,750 g upon entering the world. Most of the babies had a birth weight somewhere in the range of 1500 and 1750 g (33%). The second most basic reach was 1000–1499 g (32%). All the eight babies who required laser photocoagulation treatment had a birth weight under 1500 g and 75% of them were between 750–999 g. Likewise, the general normal gestational age was 31 weeks (range: 26–34 weeks) moreover they found that the occurrence of ROP among different developments to be 17%.

In contrast, Ali et al., [10] found that, male sexual orientation was incorporated among hazard factors for serious, treatment-requiring ROP, birth head perimeter, birth length were fundamentally connected to ROP requiring treatment.

In our study; there was no measurably huge distinction between bunch 1 and gathering 2 as respects antenatal magnesium, maternal hypertension, and method of conveyance. On the other hand, there was critical factual increment of ROP in moms with chorioamnionitis and antenatal steroids. In supported with us, Shariatiet al., [11] revealed that, there were no factually huge contrasts between the patients with and without ROP in regards to the method of conveyance ($P=0.571$), spots of conveyance (i.e., inalienable or out conceived; $P=0.282$), maternal hypertension ($P=0.112$). In can't help contradicting us, Rauf et al., [12] found that, retinopathy of rashness were 12 (26.1%) versus 6 (9.8%) separately in mother who got MgSO₄ bunch in children who conveyed before 32 weeks.

In our study, there was no factually huge distinction between bunch 1 and gathering 2 as

respects RDS, and O₂ need during revival. Then again, there was critical measurable increment ROP in children with sepsis. In concurrence with Ricard et al., [13] who discovered that, no factually huge distinction between bunch 1 and gathering 2 as respects MAS. On other hand, apnea requiring pack and cover ventilation, drawn out TPN, blood bonding, and scenes of hypoxemia and hypercarbia as danger factors for the improvement of ROP. In contrast, Shariatiet al., [11] found that the most common postnatal danger factors among patients with ROP are RDS (58%) and utilization of oxygen treatment (71%). Other critical postnatal danger factors noted were presence of sepsis (33%), transient tachypnea of the infant (20%), apnea of rashness (20%).

Satart et al., [14] announced that, newborn children with ROP had a higher rate of RDS and septicemia ($p < 0.05$). The rate of PDA was 62.2% in the gathering with any-stage ROP and 37.8% in the gathering without ROP ($p < 0.01$). Newborn children who built up any-stage ROP likewise were bound to have IVH and PVL contrasted and babies without ROP ($p < 0.05$).

In our study; There was no measurably huge distinction between bunch 1 and gathering 2 as respect Apgar score $P > 0.05$. Inclining fragments are delivered by ties; ROC bend of low birth weight demonstrating best cutoff purpose of occurrence of ROP in the examined bunches at 1.35 Kg; Sensitivity 100%; particularity 94.2%. Shariatiet al., [11] found that, 31.8% of the youngsters had an Apgar score of 7 with the ROP pace of 44.4%. In children with the Apgar score of ≤ 6 , the ROP rate was higher. Marinov et al., [15] discovered that, A low 5-minute Apgar score and an Apgar score of 6 or less at 5 minutes were not measurably critical danger components of ROP ($p=0.191$, $p=0.191$, separately), however were huge danger factors for the showed ROP to advance to stages requiring treatment ($p=0.046$, $p=0.036$, respectively). Ying et al., [16] discovered that; 1-min Apgar score <4 (OR = 1.2) was huge danger factors for any ROP.

5. Conclusion

The rate of ROP in our investigation was 4.5%. Both birth weight at cutoff point <1.5 Kg and gestational age at cutoff point <33.5 wks had high affectability and particularity in forecast of ROP. There is critical expansion in ROP among patients from mother with chorioamnionitis and patients with sepsis.

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