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Risk Factors and Outcomes of Retinopathy of Prematurity among Preterm Neonates in a Tertiary Care NICU

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Abstract **Original Research Article**

Retinopathy of Prematurity (ROP) is a significant cause of visual impairment in premature infants worldwide. In Bangladesh, increasing survival rates of preterm infants highlight the urgency of ROP screening and treatment. Early detection and intervention are crucial to prevent blindness and improve outcomes for affected children in both contexts. We aimed to identify the prenatal risk factors for ROP admission to the Institute of Child and Mother Health's NICU. Retinopathy of Prematurity (ROP) is a multifactorial condition affecting premature infants, with significant associations with gestational age, birth weight, and maternal, and perinatal risk factors. This study analyzed the incidence, risk factors, and outcomes of ROP among neonates. Infants with ROP had significantly lower gestational age (32.89 ± 2.24 weeks vs. 34.37 ± 1.68 weeks, $p = 0.001$) and birth weight (1291.27 ± 419.41 g vs. 1744.63 ± 429.89 g, $p < 0.001$) compared to those without ROP. Maternal risk factors such as antepartum hemorrhage (APH, $p = 0.03$) and prolonged rupture of membranes ($p = 0.007$) were significantly associated with ROP, with odds ratios of 5.561 (95% CI: 1.276-24.228) and 4.518 (95% CI: 1.654-12.340), respectively. Among perinatal factors, apnea emerged as the most significant risk factor (OR: 4.348, 95% CI: 1.077-17.552), while sepsis, respiratory distress syndrome (RDS), and blood transfusions were also more prevalent in infants with ROP ($p < 0.05$). Outcomes for infants with ROP included spontaneous regression in 31/55 cases, while 23/55 required intervention. Post-treatment complications were reported in 15 cases (65.21%), with refractive errors (52.17%) and squint (13.04%) being the most common. These findings emphasize the importance of monitoring maternal and perinatal risk factors, particularly APH and apnea, to identify at-risk infants. Early intervention and follow-up are crucial to managing ROP and its complications and improving outcomes for affected neonates.

Keywords: ROP, Premature Infants, Gestational Age, Birth Weight, Risk Factors.

BACKGROUND

In premature newborns, aberrant new vascular growth in the retina is a hallmark of retinalopathy of prematurity (ROP) (Institute, 2024). Because of their fragility, these aberrant blood vessels can leak or bleed, burning the retina and causing it to shift. This results in a tractional retinal detachment, which is the primary cause of blindness and visual impairment in retinopathy of prematurity (ROP) (Tae-im Kim, 2004). ROP is characterized by ophthalmoscopic findings at the intersection of the vascularized and avascular retina: a faint demarcation line at stage 1, an elevated ridge at stage 2, extraretinal fibrovascular tissue at stage 3, subtotal retinal detachment at stage 4, and total retinal detachment at stage 5 (Institute, 2024). In addition, plus disease which indicates significant vascular dilatation and tortuosity observed at posterior retinal vessels, may be present at any stage and reflects the increase in the blood through the retina (Carlos E Solarte *et al*., 2010).

Retinopathy of Prematurity (ROP), a significant and avoidable cause of childhood blindness, is typified by aberrant retinal vascular development. An estimated 50,000 incidents of juvenile blindness worldwide are attributed to ROP each year (Edward H. Wood *et al*., 2021). Based on the information that is currently available, the third epidemic—a rise in the incidence of ROP—has occurred in emerging nations. The prevalence of ROP varied by location, ranging from 38% to 47%. 1.8% of individuals had severe ROP, while 80% of patients experienced spontaneous regression.

(Anamika Dwivedi *et al*., 2019; Ashish A Ahuja *et al*., 2018). The ROP incidence was estimated to be between 40% and 50% (Bowe T, 2019). Of the patients in this study, 33.3% were diagnosed with ROP. The gestational age was 32 weeks or less in 91.7% of the cases, and 72.2% of patients had a birth weight reported between 1,000 g and 1,500 g (Hani B. AlBalawi *et al*., 2020).

In 1942, Terry first described retrolental fibroplasia, linking it to oxygen therapy as a causative factor. However, subsequent reports have identified ROP in cases without oxygen therapy, and not all premature infants exposed to oxygen develop ROP. Consistent and significant associations with Retinopathy of Prematurity (ROP) include low gestational age, low birth weight, and prolonged exposure to supplemental oxygen after delivery. Other potential risk factors encompass mechanical ventilation, sepsis, intraventricular hemorrhage, surfactant therapy, anemia, frequent blood transfusions, and apnea (Sarvesh Kossambe *et al*., 2019).

Neonatal health services have been extended throughout the country and due to improved neonatal sepsis, an increased number of preterm low birth weight babies are surviving (Sarah Sturrock *et al*., 2023). Therefore, ROP is an emerging problem. Although the magnitude of the problem has not been assessed on a large scale, ROP screening has already been initiated. Currently, neonatologists and ophthalmologists have been forward to conducting large-scale ROP screening in some reputed eye institutes and several Government and non-government institutes with support from International organizations. If screening detects ROP not needing treatment follow-up is planned according to the zone and stage of ROP. Retinopathy cryotherapy and laser photocoagulation have proven successful methods of treating active ROP.

Bangladesh is a densely populated country with a high birth rate. Retinopathy of prematurity (ROP), which is largely preventable, remains one of the leading causes of blindness in children. ROP is essentially a prematurity disease confined to the developing vascular system of the retina (Institute, 2024). All low-birth-weight, preterm babies are susceptible to ROP, and the risk increases with the degree of prematurity. The risk factors for the development of ROP include perinatal hypoxia, respiratory distress syndrome, apnea, newborn jaundice, sepsis, IDM, and blood transfusion. In addition to these variables, maternal risk factors for ROP include maternal age, maternal hypertension, APH, prolonged membrane rupture, and prenatal steroid use. ROP-induced blindness usually develops within a few weeks of birth and is permanent. Since vision plays a major role in early learning, ROP blind infants are also susceptible to developmental delays, which can impact their emotional, social, and physical development. Each of these elements may significantly affect the impacted child, and their Retinopathy of Prematurity under constant epidemiological study around the world. Early identification of retinal damage and the institution of appropriate treatment prevent blindness and offer children better overall development (Hakeem *et al*., 2012). There are significant social and economic advantages to screening programs and early intervention. Consequently, the goal of this research is to identify ROP and the issues related to it. The frequency of ROP is predicted to rise in Bangladesh as the survival rate of premature and low birth weight babies improves. It is impossible to prevent premature birth even with excellent efforts to reduce the risk and enhance prenatal care. However, ROP-related blindness or visual impairment is mostly avoidable. In this study, we aimed to identify the prenatal risk factors for ROP admission to the Institute of Child and Mother Health's NICU. This research will be useful in identifying and addressing issues related to ROP, and prompt treatment will help avoid blindness from retinopathy of prematurity.

METHODOLOGY

Study Settings and Participants

The study was conducted in the Neonatology Unit, a tertiary care neonatal intensive care unit (NICU) of the Pediatrics Department at the Institute of Child and Mother Health (ICMH). This 30-bedded unit primarily admits neonates with prematurity and asphyxia. This study was an observational follow-up study focusing on preterm and low-birth-weight neonates at risk of Retinopathy of Prematurity (ROP). The study was carried out over a one-year period from July 2022 to June 2023, following the approval of the research protocol. The ROP screening was facilitated by the Ret-cam, provided by Orbis. The study included preterm neonates with a gestational age of ≤35 weeks and/or birth weight ≤1500 grams admitted to the NICU. Infants with congenital anomalies were excluded.

Sample Size

A total of 96 neonates were enrolled in the study, with 55 diagnosed with retinopathy of prematurity (ROP) and 41 serving as controls without ROP were collected purposively after meeting our inclusion criteria.

Study Procedure

In the NICU, neonates at risk for Retinopathy of Prematurity (ROP) were identified, and a comprehensive history and physical examination were carried out. Gestational age was determined using maternal last menstrual period, ultrasonography, and the New Ballard Score. Screening was generally performed at different time points post-birth—21–30 days, 31–40 days, and >40 days. Prior to examination, tropicamide (0.5%) and phenylephrine (2.5%) eye drops were administered 10–15 minutes apart to dilate the pupils. ROP examinations were conducted under topical anesthesia using an indirect ophthalmoscope and a 20D condensing lens. Findings were meticulously documented, and follow-up schedules adhered to the guidelines set by the International Classification of Retinopathy of Prematurity (ICROP). The frequency of follow-up varied according to the zone and stage of ROP, ranging from weekly to biweekly intervals.

Data Collection

Data were collected using a pre-tested semi-structured questionnaire. Key information included demographic details, maternal and neonatal risk factors, and findings from ROP examinations.

Independent Variables: Maternal risk factors included maternal age, hypertension, APH, PROM, and antenatal steroid use. Neonatal variables included gestational age, birth weight, sepsis, apnea, RDS, jaundice, perinatal asphyxia, and the need for blood transfusions.

Dependent Variables: Stages of ROP and associated eye conditions such as squint, refractive error, and retinal detachment.

Data Analysis

Statistical analyses were performed using SPSS version 23.0. Descriptive statistics were used to summarize categorical and continuous variables. Chi-square tests were employed to assess associations between risk factors and ROP, and independent t-tests were used to compare means between groups. Multivariate logistic regression was conducted to identify significant maternal and neonatal risk factors for ROP, with results reported as odds ratios (OR) with 95% confidence intervals (CI). Statistical significance was defined as $p < 0.05$.

Ethical Considerations

The researcher prioritized ethical integrity throughout the study. Formal ethical clearance was obtained from the Institutional Review Board (IRB) of the Institute of Child and Mother Health to ensure that all aspects of the research adhered to ethical standards. Confidentiality of both the participants and the data was strictly maintained, with measures in place to prevent unauthorized access. Informed written consent was obtained from each parent of the baby, clearly outlining the nature and purpose of the study, the procedures involved, and the right of participants to refuse, accept, or withdraw from the study at any time without any repercussions. Participants were assured that no financial benefit would be gained from the study, maintaining transparency and ethical fairness.

Operational Definitions

Key terms such as ROP, its stages, zones, and related neonatal conditions like apnea, sepsis, and prolonged oxygen therapy were defined according to established clinical guidelines, see supplementary file A.

RESULTS

Among 96 participants 55 (57.3%) babies were found in ROP (Figure 1).

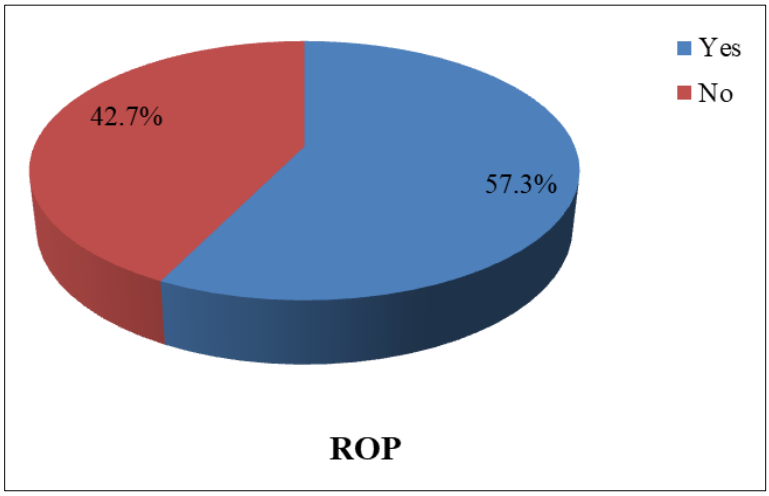

Figure 1: ROP of the study population

The table 1 compares the incidence of retinopathy of prematurity (ROP) with gestational age among neonates. It shows that a significant difference exists in gestational age between infants with ROP (mean ± SD: 32.89 ± 2.24 weeks) and those without (mean ± SD: 34.37 ± 1.68 weeks; p = 0.001). Similarly, birth weight significantly differed between infants with ROP (mean ± SD: 1291.27 ± 419.41 gm) and those without (mean ± SD: 1744.63 ± 429.89 gm; p < 0.001)

Table 1: Association of gestational age and birth weight with ROP

Gestational age (weeks)	**ROP**				**Total**	**X^2**	**p value**
	Present (n=55)		**Absent (n=41)**				
	n	**%**	**n**	**%**			
28-30	8	14.55	0	0.00	08		
31-35	41	74.55	30	73.17	71	9.33	0.009
>35	6	10.91	11	26.83	17		
Mean±SD	32.89(±2.24)		34.37(±1.68)				0.001
Birth weight (gm)							
< 1000 gm	5	9.09	0	0.00	05		
1000-1499 gm	37	67.27	13	31.71	50	5.90	0.003
≥ 1500 gm	13	23.64	28	68.29	41		
Mean ±SD	1291.27(±419.41)		1744.63(±429.89)				<0.001

Maternal risk factors were compared between infants with and without ROP. Significant differences were observed for maternal age (p = 0.02), antepartum hemorrhage (APH, p = 0.03), and prolonged rupture of membranes (p = 0.007). Infants with ROP were more likely to have mothers with APH (13/55) or prolonged rupture of membranes (30/41) (Table 2).

Table 2: Association of maternal risk factors with ROP

Maternal risk factors		**ROP (n=55)**		**No ROP (n=41)**		**Total**	**X^2**	**p value**
		n	**%**	**n**	**%**			
Maternal age (years)	<20	24	43.64	8	19.51	**32**		
	20-25	21	38.18	18	43.90	**39**	7.34	0.02
	26-30	10	18.18	15	36.59	**25**		
Maternal hypertension	Present	7	12.73	2	4.88	**9**	1.70	0.29
	Absent	48	87.27	39	95.12	**87**		
APH	Present	13	23.64	3	7.32	**16**	4.50	0.03
	Absent	42	76.36	38	92.68	**80**		
Prolonged rupture of membrane	Present	30	54.55	11	26.83	**41**	7.37	0.007
	Absent	25	45.45	30	73.17	**55**		
Antenatal use of steroid	Present	15	27.27	6	14.63	**27**	2.19	0.108
	Absent	40	72.73	35	85.37	**69**		

Perinatal risk factors were analyzed and showed significant differences between the two groups for apnea (p = 0.003), respiratory distress syndrome (RDS, p = 0.04), and blood transfusions (p = 0.02). Infants with ROP had a higher incidence of these risk factors. The incidence of sepsis was significantly higher among infants with ROP (44/67) compared to those without (23/29; p = 0.01) (Table 3).

Table 3: Association of perinatal risk factors with ROP

Risk factors		**ROP (n=55)**		**No ROP (n=41)**		**Total**	**X^2**	**p value**
		n	**%**	**n**	**%**			
Sepsis	Present	44	80.00	23	63.41	**67**	6.36	0.01
	Absent	11	20.00	18	29.27	**29**		
Apnoea	Present	19	34.55	3	7.32	**22**	9.85	0.003
	Absent	35	63.64	35	85.37	**70**		
Neonatal Jaundice	Present	47	85.45	33	80.49	**80**	0.82	0.74
	Absent	7	12.73	6	14.63	**13**		

Risk factors		ROP (n=55)		No ROP (n=41)		Total	X^2	p value
		n	%	n	%			
Respiratory distress syndrome	Present	10	18.18	2	4.88	**12**	4.58	0.04
	Absent	44	80.00	39	95.12	**83**		
Perinatal asphyxia	Present	8	14.55	9	21.95	**17**	.88	0.36
	Absent	46	83.64	32	78.05	**78**		
IDM	Present	2	3.64	1	2.44	**03**	0.11	1.0
	Absent	53	96.36	40	97.56	**93**		
Blood transfusion	Present	37	67.27	18	43.90	**55**	5.24	0.02
	Absent	18	32.73	23	56.10	**41**		

The table compares the incidence of various risk factors between infants with ROP (Retinopathy of Prematurity) and infants without ROP. The risk factors included in this study are sepsis, apnea, neonatal jaundice, respiratory distress syndrome, perinatal asphyxia, infant of diabetic mother (IDM) and blood transfusion.

The data shows that there is a significant difference in the incidence of apnea (p-value 0.003), respiratory distress syndrome (p-value 0.04) and blood transfusions between (p-value 0.002) the two groups, with infants with ROP being more likely to have these risk factors.

In addition, the incidence of sepsis was significantly higher in infants with ROP (44/67) compared to those without ROP (23/29) with a p-value of 0.01.

Figure II shows that 53 cases were found ROP. Among them 36 (52.9%) were in zone III and 32(47.1%) were in zone II. Two cases ROP stage V (total retinal detachment).

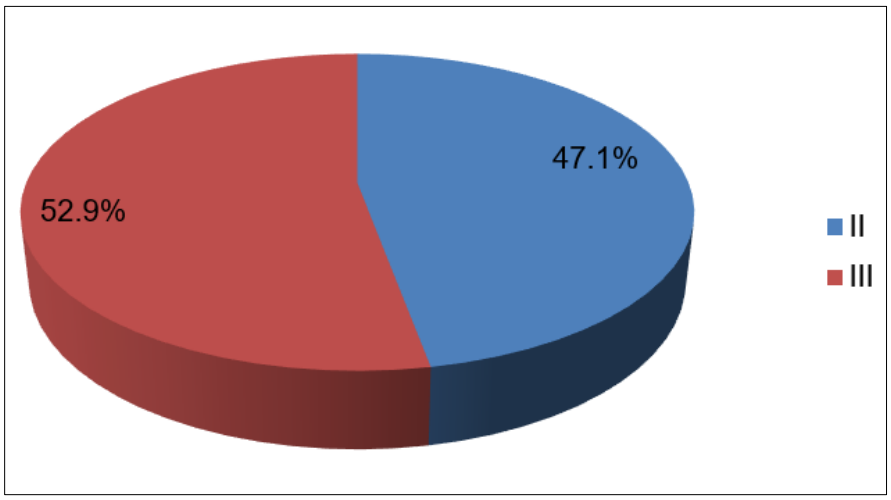

Figure 2: Distribution of Zone study neonate according to national guide line of ROP

The Table 4 illustrates that, the outcomes between infants with ROP (Retinopathy of Prematurity). The outcomes for infants with ROP included regression of the disease spontaneously (31/55) or requiring intervention (23/55). One infant with ROP was lost to follow-up.

Table 4: Outcome of ROP

Outcome of ROP	Number	Percentage
Regressed spontaneously	31	56.36
Need intervention	23	41.82

Figure 3 shows that 23 cases need intervention among them 2(8.7%) surgery, 6(26.1%) anti-VEGF and 15(65.2%) laser therapy.

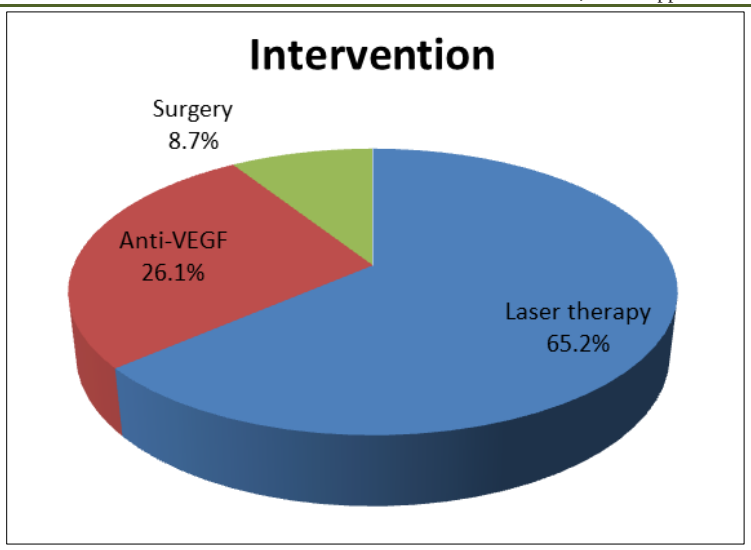

Figure 3: Pie chart showing intervention of the study neonate

After treatment, complications were reported in 15 (65.21%) cases: 12 (52.17%) developed refractive error and 3 (13.04%) developed squint (Table 5).

Table 5: Patients developed complications after treatment (n=23)

Complications	**Number**	**Percentage**
Developed refractive error	12	52.17
Squint	03	13.04
Total	**15**	**65.21**

Table 6 portrayed that, perinatal risk factors associated with Retinopathy of Prematurity (ROP). Apnoea was identified as the most significant risk factor with an odds ratio of 4.348 (95% CI: 1.077-17.552, p = 0.039). Other factors, such as sepsis, respiratory distress syndrome, blood transfusion, gestational age, and birth weight, showed no significant associations with ROP (p > 0.05).

Table 6: Relationship of perinatal risk factors with ROP

Perinatal risk factors	OR	95% C.I.		p value
		Lower	Upper	
Sepsis	1.842	.602	5.638	0.285
Apnoea	4.348	1.077	17.552	0.039
RDS	2.757	.506	15.035	0.241
Blood transfusion	1.644	.578	4.674	0.351
Gestational age	3.661	.837	16.015	0.085
Birth weight	.982	.267	3.614	0.979

Antepartum hemorrhage (APH) was identified as a significant maternal risk factor, with an odds ratio of 5.561 (95% CI: 1.276-24.228, p = 0.022), indicating that infants born to mothers with APH had a higher likelihood of developing ROP. Prolonged rupture of membranes also emerged as a significant risk factor, with an odds ratio of 4.518 (95% CI: 1.654-12.340, p = 0.003). Maternal age and antenatal use of steroids did not show a significant association with ROP in this study (p > 0.05) (Table 7).

Table 7: Relationship of maternal risk factors with ROP

Maternal risk factors	OR	95% C.I.		p-value
		Lower	Upper	
Maternal age	1.658	0.883	3.115	0.116
APH	5.561	1.276	24.228	0.022
Prolonged rupture of membrane	4.518	1.654	12.340	0.003
Antenatal use of steroid	1.864	.564	6.164	0.307

DISCUSSION

This study was carried out with the aim to determine the risk factors associated with ROP among the neonates admitted in Neonatal intensive care unit. A total of 96 premature and LBW babies were included in this study. In this study preterm babies with birth weight <2000 gm and gestational age <35 wks and if they had additional risk factors were screened for retinopathy of prematurity. In a recent article in India, Shroff K *et al*., 2020 have suggested birth weight <2000 gm and <34 weeks gestational age is screening criteria. Among 293 baby's prevalence of ROP was 32%, 93 babies were very low birth weight (31.7%) < 1000 gm, 35 babies were 46% (1000-2500 gm) ROP was found 52 out of 93VLBW (55%) and 40 out of 135 LBW babies 29% p value was <0.001.

Two hundred and forty infants met inclusion criteria of screening; among whom 132 were males (55%). They had a mean gestational age of 33.25±2.74 weeks (range: 26–39 weeks). Mean birth weight 1955.23±692.43 g (range: 820–5500 g). Eighty-two included infants (34.1%) had ROP; including 63 infants with type 1 ROP that required therapeutic intervention. Treatment was performed in the form of intravitreal injection of an anti-VEGF drug. Ongoing surveillance for recurring ROP after anti-VEGF therapy was done by follow-up fundus examination visits even after discharging the baby from NICU until the age of 65 weeks, there was no recurring ROP after the anti-VEGF therapy (Raouf Gaber *et al*., 2021).

The incidence of ROP in preterm infants under 32 weeks was 60.9% (53 of 87), while for those weighing less than 1500 grams it was 71.6% (48 of 67). Bivariate statistical analysis shows that ROP is significantly (p <0.01) associated with gestational age below 32 weeks (OR = 9.02), birth weight below 1500 grams (OR = 13.15), neonatal sepsis (OR = 15.0), oxygen therapy (OR = 10.2), mechanical ventilation (OR = 6.232), hyaline membrane disease (OR = 12.14), bronchopulmonary dysplasia (OR = 3.36), ductus arteriosus persistence (OR = 4.14) and intraventricular hemorrhage (OR = 15.40) (Carmen Sarita Carranza-Mendizabal *et al*., 2021).

In this study, among the 96 pre-term infants 55(57.3%) were diagnosed as ROP. The prevalence of retinopathy of prematurity was 57.3%. However, the prevalence of retinopathy of prematurity is higher in this study because most of the babies were admitted at NICU due to preterm and low birth weight with critical condition. Another explanation may be improvements in Neonatal intensive care unit result increased survival of premature infants with a more complicated course.

Sixty babies were enrolled for the study with mean birth weight of 892.983±112.933 (560 to 1000) grams and mean gestation age of 29.47±2.258 (25-35) weeks. The incidence of ROP in this cohort was 50% (30 infants), out of which 23% (7 infants) required treatment (laser photocoagulation). The statistical analysis of risk factors on univariate analysis revealed a significant association for oxygen exposure, apnoea, surfactant use, anaemia, blood transfusion, intraventricular haemorrhage, sepsis and antibiotic use. On multivariate logistic regression analysis anemia and oxygen exposure > week were found to be independent risk factors for development of ROP.

Current study observed compares the incidence of ROP with gestational age among neonates. It shows the number and percentage of cases with ROP and without ROP in three different gestational age groups (<30 weeks, 31-35 weeks, >35 weeks). The data suggests that there is a significant difference in gestational age between with ROP and without ROP, as evidence by the P-value of 0.001. Infants with ROP had a lower mean gestational age of 32.89±2.24 weeks compared to infants without ROP who had a mean gestational age of 34.37± 1.68 wks. Maximum incidence was seen in neonate gestational age 31 to 35 weeks (74.5%). A study was done by Nahar N *et al*., (2018) Ispahani Islamia Eye Hospital and Institute that study showed, screened over 2000 pre-term infant, 40% of the babies had birth weight between 1500-2000 gm and 38% had < 1500 gm. The mean gestational age of babies of ROP was 31.9±2.28 weeks (Nazmun Nahar *et al*., 2018).

Risk factors predisposing to ROP were sepsis, apnoea, respiratory distress syndrome and blood product transfusion that is ultimately suggestive that all risk factors are directly or indirectly related to supplemental oxygen therapy. Compbell was the first to suggest that supplemental oxygen was the cause for sudden increase in the numbers of infants developing Retro Lental Fibroplasias (RLF) in the early 1940s (CAMPBELL, 1951). Lin et al, conclusion that extremely premature infants with fluctuating arterial oxygen probably have a higher risk of developing progressive ROP (Wei-Chun Lin *et al*., 2024). Chen *et al*., clinical implication from these three studies is that, with respect to ROP development, arterial oxygen levels are particularly critical within first weeks after birth probably in (4-6 weeks) (Chen JS *et al*., 2021).

The study compared the maternal risk factors between infants with ROP and without ROP. The maternal risk factors include maternal age, hypertension, antepartum haemorrhage (APH), prolonged rupture of membrane. The data shows that there is a significant difference between the two groups for maternal age, APH and prolonged rupture of membrane, as evidenced by their P-values of 0.02. 0.03 and 0.007 respectively. Infants with ROP were more likely to have mothers who had APH (13/55) or prolonged rupture of membrane

(30/41). However, there was no significant difference in maternal hypertension between the two groups (P-value 0.09). Zhu *et al*., observed 16 patients were found maternal hypertension in ROP group and 4 in non ROP group. APH had seen in eighteen mothers of ROP babies and 12 in no ROP group. The difference were not statistically significant (P >0.05) between two groups(TingTing Zhu *et al*., 2017).

In this study, sepsis was found as a significant risk factor. Among 67 out of 96 cases had sepsis. Out of 67 cases 44 (72.2%) newborn had ROP. Incidence of sepsis was significantly higher in infants with ROP (44/67) compared to those no ROP (23/29) with a P-value of 0.01. In this study, 22 (22.91%) out of 96 cases had apnea. Out of 22 cases 19(35.19%) had ROP. In 55 ROP positive cases 19(34%) had apnea (P=0.003). In a study done by Umadevi *et al*., in 2004 apnea came as a significant risk factor. In the present study among 12(12.5%) out of 96 cases had RDS. Out of 12 cases 10 (8.3%) had RDS. In 55 positive cases 10 (18.1%) had RDS (P=0.04) (M., 2019).

Current study showed among 55 (43.9%) out of 96 cases of newborn had need blood transfusion. Out of 55 cases 37(67.2%) had ROP. There is a significant association ROP with blood transfusion with P value of 0.02. The multiple regressions showed that apnoea was 4.3-time significant perinatal risk for ROP OR 4.34 (1.077-17.55) p value 0.03 and APH was 5.56-time significant maternal risk for ROP OR 5.56 (1.27-24.22) p value 0.02. APH was 4.51-time significant maternal risk for ROP OR 4.51 (1.65-12.34) p value 0.003. In a study done by Hesse *et al*., there was a significant association between blood transfusion and ROP (P=0.0001) (L Hesse *et al*., 1997). However, there was no significant difference in the incidence of neonatal jaundice perinatal asyphgxia and infant of diabetic mother between the two groups. Low birth weight, low gestational age, oxygen therapy, sepsis, apnea and blood transfusion were risk factors for ROP. After logistic regression analysis only, low GA and LBW were independently associated with ROP.

In this study observed that 55 neonates were developed ROP. Among them one neonate missing during follow up 5 cases had (9.1%) stage 1 ROP (one missed no number 4), 30 (54.5%) cases had stage 2 ROP, 15 cases (27.3%) had stage 3, 3(5.5%) cases had stage 4 and 2(3.6%) had stage 5 of ROP. Bassiouny *et al*., (2017) reported that out of the 402 screened preterm babies, 237 (59%) cases had ROP, among whom 101 (42.6%) had stage 1, 114 (48.1%) had stage 2, 12 (5.1%) had stage 3, 10 (4.2%) had aggressive posterior retinopathy, and 24 (10.1%) presented with plus disease. The outcome for infants with ROP regress spontaneously 31(56.3%) and needed intervention 23(41.82%), 2(8.7%) cases needed surgery, 6(26.1%) cases were given injection anti-VEGF and laser therapy was done in 15(65.2%) cases. The rest of the eight babies didn't develops any complications.

Strength and Limitations

The strength of the current study is administered within a single hospital setting in an urban area. However, it has also limitations the long-term outcome could not be assessed due to time constraints. Moreover, regular follow-up could not be maintained.

Recommendations

Regular antenatal and neonatal care, meticulous attention to hygienic procedures, control of sepsis, judicial use of blood transfusion, and safe implementation of oxygen therapy may reduce the incidence of ROP. Therefore, monitoring standards of neonatal care and conducting quality improvement projects across the country are essential for improving neonatal outcomes. The need for a routine screening programme for the detection of retinopathy of maturity according to the national guidelines for the management of retinopathy of prematurity.

CONCLUSIONS

In developing countries such as Bangladesh, our babies suffer more because of suboptimal neonatal care, lack of awareness, and not-in-place/ improper screening and treatment programs. Suppose the awareness can be improved for referral for ROP screening in recognized equipped centers, and after diagnosing the actual picture, treatment with laser or injection anti-VEGF in time can be given by experts. In that case, it will reduce the burden of blindness, as we have shown in our results. A longer follow-up will give a more detailed evaluation of the impact of ROP treatment on the visual status of children.

Supplementary Information
Operational Definition
ROP:

Retinopathy of Prematurity (ROP) characterized by abnormal development of retinal vasculature in premature babies. Clinical manifestation ranges from mild usually transient changes of the peripheral retinal to severe progressive vaso-proliferation, scarring and potentially blinding retinal detachment. To delineate location the retinal is divided into 3 concentric zones, centred on the optic disc and the severity of the disease process are classified into 5 stages.

ROP Stage:

- Stage 1: A thin white line which separates the vascular from the avascular retina
- Stage 2: A ridge develops from the demarcation line, which has both height and width. May have isolated tufts of neovascular tissue on the surface of the retina (popcorn)

- Stage 3: Extraretinal neovascular proliferation with abnormal vessels and fibrous tissue arising from the ridge and extending into the vitreous
- Stage 4: Partial retinal detachment; not involving the fovea (4a) or involving the fovea (4b)
- Stage 5: Complete retinal detachment

ROP Zone:

- Zone I: A circular area surrounding the optic disc which has a radius of twice the distance from the optic nerve to fovea. Disease in Zone 1 has a worse prognosis than disease in Zones 2 or 3.
- Zone II: circular band of retina which extends from the edge of Zone 1 to the ora serrata nasally and to the equatorial are temporally.
- Zone III: A crescent shaped area on the temporal side which extends from Zone 2 to ora-serrata.

Gestational Age:

Gestational age defined by the American Academy of Pediatrics is the time elapsed between the first day of last menstrual period and the day of delivery.

Preterm: Babies born before 37 completed weeks of gestation

Low Birth Weight: Babies born with birth weight less than 2500 gm

Very Low Birth Weight: Babies born with birth weight less than 1500 gm

Apnea:

Apnea is the absence of breathing for >20 sec or shorter pause (>10 sec) associated with oxygen desaturation and or bradycardia (<100 beats/min).

Sepsis: Neonatal sepsis is a clinical syndrome of systemic illness accompanied by bacterimia occurring in the first month of life.

Prolonged use of Oxygen Therapy:

Prolonged use of oxygen therapy can be defined as oxygen used for at least 15hours per day in chronically hypoxemic patients.

Squint: Also known as strabismus, where the eye is not aligned in the name direction.

Retinal Detachment: An emergency situation in which a thin layer of retina at the back of the eye pulls away from its normal position.

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