

Retinal Haemorrhage in Newborns in Tertiary Care Hospital

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Citation

Makaju Shrestha R, Shrestha S, Sharma S, Joshi A, Shrestha P, JK Shrestha. Retinal Haemorrhage in Newborns in Tertiary Care Hospital. *Kathmandu Univ Med J.* 2022;80(4):483-7.

ABSTRACT

Background

Retinal haemorrhage in new-born is a clinically common neonatal fundus condition. Although, it usually does not affect the development of visual function, entities like macular haemorrhages may lead to amblyopia causing deterioration of visual function. Such scenario leads to downgrade in quality of life of the affected child.

Objective

To explore the underlying clinical factors associated with retinal haemorrhage in term new-borns.

Method

A cross sectional study was conducted involving 136 term neonates admitted in the neonatal intensive care unit of Dhulikhel Hospital. Fundus examination was performed within 2 weeks of delivery. Retinal haemorrhage was graded according to their location in three retinal zones.

Result

Out of 136 cases examined, 44 (32.35%) of the cases had one of the eyes with retinal haemorrhage. Where grade 1 retinal haemorrhage was accounted in majority of the cases. Birth weight, gestational age, mode of delivery, poor Appearance, Pulse, Grimace, Activity, and Respiration (APGAR) Score in 1 and 5 minutes, birth asphyxia, neonatal sepsis and heavy work in antenatal period had statistically significant correlation with occurrence of retinal haemorrhage.

Conclusion

Our results suggest that spontaneous vaginal delivery, larger birth weight, higher gestational age, birth asphyxia, low Appearance, Pulse, Grimace, Activity, and Respiration score, are risk factors for occurrence of neonatal retinal haemorrhage. It is recommended that in neonates with above high-risk factors should undergo targeted fundus screening for early identification and needful interventions.

KEY WORDS

Asphyxia, New-born, Retinal haemorrhage

INTRODUCTION

Researchers have suggested that the full-term new-borns with various antenatal and perinatal risk factors such as perinatal asphyxia, hypoxic ischemic encephalopathy (HIE) are at risk of developing retinal hemorrhage.¹ Cases of retinopathy of prematurity-mimicking disorders have been reported in neonates who did not require supplementary oxygen.² Internationally, retinal haemorrhage in new-born is common, with morbidity ranging from 2.6% to 50%.³⁻⁷ This wide-ranging incidence may be possibly due to timing of eye examination and the method employed for examination.⁴ Similarly, the patients' demographics might also play important role in the varied incidence of retinal haemorrhage. As most of the studies are concerted on screening of preterm babies for retinopathy of prematurity which had a preformed fix procedure, majority of clinicians know quite little about the retinopathy among term new-borns. There are several potential causes of retinal haemorrhage in neonate. Haemorrhage at birth may occur after traumatic deliveries: vacuum assisted deliveries, forceps deliveries. Likewise, neonatal coagulopathies associated with sepsis, shaken baby syndrome and intracranial haemorrhage may also precipitate to retinal haemorrhage.¹ In order to find the possible retinopathy amongst term new-borns in the early stage and investigate the probable relationship between the influencing factors and retinopathy, fundus screening on term new-borns is crucial. Currently, the risk factors and mechanism underlying neonatal retinal haemorrhage are not well-understood. It may also be related with systemic and other ocular pathologic factors including intracranial disorders, haematological disturbances, chorioretinal infections and retinal vascular disorders.³ While there are studies reporting risk factors analyses of retinal haemorrhage, there are no known systemic investigations of the correlation between the various risk factors and the degree of retina haemorrhage. The retinopathies in term new-borns are commonly observed in high-risk pregnancies due to gestational diabetes mellitus, chronic heart-lung disease, pregnancy-induced hypertension or abruption placenta. Moreover, these are also seen in high-risk delivery history such as precipitate labour, prolonged labour and induction of labour or asphyxia history.³ Nevertheless, countless factors can affect the hemodynamic status of new-born's brain increasing the threat of cerebral lesion as a result leading to retinal haemorrhage. Hence, it is necessary for the ophthalmologist to conduct timely examination to diagnose and assess such neonates.

METHODS

It is a retrospective-prospective observational hospital-based study. In our study, we included all the term neonates admitted to neonatal intensive care unit (NICU)

from September 2020 - August 2021 for evaluation. The study was approved by the Kathmandu University School of Medical Sciences - Internal Ethics Review Committee. Neonates diagnosed with retinal haemorrhage were further segregated for detailed analysis. All neonates with gestational age of more than 37 weeks underwent fundus screening with the consent of their families. Neonates with severe systemic diseases (e.g., tetralogy of Fallot and phenylketonuria) or other eye diseases (e.g., congenital cataracts and primary congenital glaucoma) or whose mothers had known hereditary diseases were excluded from the study. We collected detailed information for each new-born, taking into account general, maternal, obstetric, and neonatal parameters. Eye examinations were conducted within 2 weeks of birth. All eye examinations, imaging, and readings were performed by the principal investigator. Anterior segment examination was done with a torch light and/or with a portable slit lamp. After which fundus examination under mydriatics was performed. A neonatal eye speculum was used to keep the eyes open. Heine indirect ophthalmoscope and Volk 20 D lens were used to view the fundus.

Neonatal retinal haemorrhage (RH) was classified based on classification by Egge et al.⁸ Presence of retinal haemorrhage in at least one eye of any degree was considered positive for presence of retinal haemorrhage. Statistical Analysis was done using SPSS version 20.0, we conducted univariate logistic regressions analysis to compare presence of retinal haemorrhage with various factors such as maternal, obstetric, and neonatal factors. P values lower than 0.05 were considered statistically significant.

RESULTS

Retinal haemorrhage (RH) was found in 44 (32.35%) of 136 new-borns examined. Monocular RH occurred in 12 of the cases (8.82%), while the remaining 32 cases (23.52%) had binocular involvement.

Right eye involvement was seen in 42 (30.88%) cases out of which 26 cases (19.10%) had grade I, 14 cases (10.30%) had grade II and 2 cases (1.50%) had grade III RH.

Meanwhile out of 42 left eye involvement 22 cases (16.20%) had grade I, 10 cases (7.40%) had grade II and 2 cases (1.50%) had grade III RH.

A univariate logistic regression showed that the birth weight, gestational age, mode of delivery, Appearance, Pulse, Grimace, Activity, and Respiration (APGAR) Score in 1 and 5 minutes, birth asphyxia and neonatal sepsis were significant factors ($p < 0.05$). However, gender, maternal age, maternal height, neonatal respiratory distress, smoking, alcohol intake during pregnancy and parity were not associated with retinal haemorrhage.

Table 1. Patterns of retinal haemorrhage in Right Eye

RH in right eye	Frequency (%)
Normal	94 (69.10)
Grade 1	26 (19.10)
Grade 2	14 (10.30)
Grade 3	2 (1.50)
Total	136 (100)

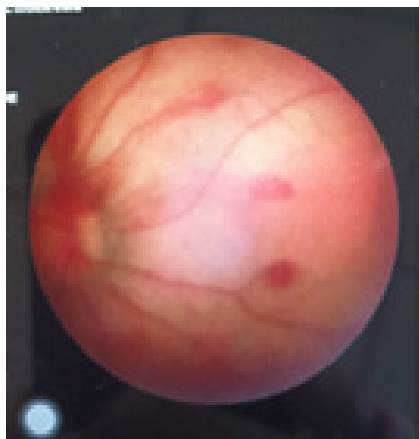
Table 2. Pattern of retinal haemorrhage in left eye

RH in left eye	Frequency (%)
Normal	102 (75.00)
Grade 1	22 (16.20)
Grade 2	10 (7.40)
Grade 3	2 (1.50)
Total	136 (100)

Table 3. Showing univariate logistic regression analysis of different variables with retinal haemorrhage

	B	S.E	Wald	Df	Sig.	Exp (B)	95.0% C.I.for EXP(B)	
							Lower	Upper
Gender	0.915	1.153	0.629	1	0.428	2.496	0.26	23.918
Maternal age	0.218	0.225	0.938	1	0.333	1.244	0.8	1.933
RDS	-1.514	1.756	0.742	1	0.389	0.22	0.007	6.872
Neonatal Sepsis	-2.754	1.083	6.472	1	0.011	0.064	0.008	0.531
MAS	0.105	1.033	0.01	1	0.919	1.11	0.147	8.414
Maternal Weight (Kg)	0.049	0.112	0.19	1	0.663	1.05	0.843	1.307
APGAR score in 1 min	-1.584	0.77	4.23	1	0.04	0.205	0.045	0.928
APGAR score in 5 min	2.138	0.738	8.402	1	0.004	8.483	1.998	36.005
Birth Weight (grams)	-0.002	0.001	4.605	1	0.032	0.998	0.995	1
Birth Asphyxia	-0.936	0.385	9.903	1	0.015	0.392	0.184	0.834
Gestation(weeks)	1.261	0.576	4.8	1	0.028	3.529	1.142	10.907
Mode of Delivery	-1.237	0.681	4.008	1	0.045	0.29	0.086	0.974
Maternal Height	-2.926	2.697	1.177	1	0.278	0.054	0	10.599
Gravida	-1.453	1.232	1.39	1	0.238	0.234	0.021	2.618
maternal Systemic Illness	0.345	0.786	0.193	1	0.661	1.412	0.303	6.584
Smoking	-23.621	2.843	0	1	0.999	0	0	0
Alcohol Intake	45.488	3.313	0	1	0.999	5.69	0	0

Among the 44 cases with RH, the mean age at the first funduscopic examination was 5.95 days. In regards with laterality of RH, 12 (27.30%) had unilateral whereas, 32 (72.70%) had bilateral RH. The RH were dot, blot or flame shaped.

**Figure 1. Grade 3 retinal haemorrhage in a new-born, photograph taken by Remedio fundus camera.****Table 4. Basic information of those infants with retinal haemorrhage**

Demographic features of 44 neonates with retinal haemorrhage	
No. of neonates	136
No. of at least one eye affected	44
Laterality	
Unilateral	12 (27.30%)
Bilateral	32 (72.70%)
Mean gestational age (weeks)	39 ± 0.96
Mean birth weight (grams)	3109.54 ± 480.45
Male: female	1:1.2
Mean age at first examination (days)	5.95 ± 2.59
Mode of delivery	
SVD	26 (59.10%)
Emergency LSCS	10 (22.70%)
Vacuum assisted vaginal delivery	8 (18.20%)
Elective LSCS	0 (0.00%)

Values are presented as mean ± SD or number (%)

DISCUSSION

Retinal haemorrhage has been one of the most common neonatal ocular abnormalities in new-borns and it has currently drawn more focus of the ophthalmologist and the paediatricians. With the rapid development of neonatal retinal examination methods and various emerging technologies such as Ret Cam, there is an increase in the detection rate of retinal haemorrhage.⁹

In our study the incidence of neonatal retinal haemorrhage was 44% which was consistent with the findings from study by Mao et al. and Lui et al.^{10,11} However, the prevalence of retinal haemorrhage in the US which was recorded by Ret-Cam was 34%.⁵ Similarly, it was 39.9% in a study by Yanli et al. which is close to our incidence.⁹ Though, in a survey of high-risk factors affecting retinopathy in full-terms infants in China showed a lower incidence of 18%.^{1,6,12} Nevertheless, the incidence rate of neonatal retinal haemorrhage has shown to vary from 2.6 to 50%.^{3,4}

In our study majority of the retinal haemorrhage were of grade 1 according to Classification Degree of Neonatal Retinal Haemorrhage based in Egge et al.⁸ This contradicted to study by Qinglan et al. where they had almost equal distribution of all grades of retinal haemorrhage.⁹ Meanwhile, Yanli et al. had maximum of grade II type of retinal haemorrhage.⁹

Comparable to our findings regarding laterality, where 2/3rd of our cases had bilateral haemorrhage, Qinglan et al. in their study had 50% of their cases with bilateral retinal haemorrhage.¹⁰

In the recent years, researchers have begun studying the risk factors and mechanism underlying neonatal retinal haemorrhage. For instance, Choi et al. proposes a link between retinal haemorrhage and pressure of the foetal head in the birth canal, such as compression of the foetal head during delivery causes deformation which leads to elevated intracranial venous pressure, perivascular congestion, and expansion or rupture resulting in haemorrhage.¹³ The result of various series of studies suggested that spontaneous vaginal delivery is a risk factor for neonatal retinal haemorrhage and that the caesarean section is a protective factor.¹⁴ Likewise, various other studies have also found out that the spontaneous vaginal delivery (SVD) was associated with increase in the occurrence of retinal haemorrhage which was alike to study by Yanli et al.⁹ Retinal haemorrhage was higher in new-born following vaginal deliveries or deliveries with obstetric forceps, compared with caesarean section deliveries in accordance with previous studies by Emerson et al. and Hughes et al.^{4,5} Watts et al. similarly reported that, compared with SVD, caesarean section significantly lowers the incidence of neonatal retinal haemorrhage.¹⁵ The underlying mechanism may be due to the compression of the foetal head during vaginal delivery specifically, the

intracranial pressure suddenly increases during vaginal delivery, which is accompanied by a pressure increase in the central retinal vein. At the same time, the scalp veins and intracranial veins dilate due to venous return obstruction.

Paramei et al. reported that in asphyxiated new-borns, the possibility of intraocular haemorrhage should be considered.¹⁶ Lack of oxygen supply in foetus may cause congestion of retinal vein as well as increase of blood viscosity which may result in retina haemorrhage after birth. Neonatal asphyxia was the main cause of retinal haemorrhage in various other studies as well.^{1,16}

We found that some cases with severe asphyxia had very mild retinal haemorrhage while large area of flame-shaped retinal haemorrhage occurred in some cases with very mild asphyxia. Similar result was found in infants with HIE.¹⁴ But the quantity of samples in our study is not enough to cover most of the situations which might cause bias in the result, so we need further research to confirm our conclusion.

There are studies showing advanced maternal age is a risk factor for increased retinal haemorrhage. Women of advanced maternal age tend to experience anxiety, depression, and other negative emotions, increasing the risks toward themselves and their foetuses.¹⁷

There are also reports showing RH was higher for younger mothers < 22 years old, which may possibly be the result of greater birth canal resistance due to primiparity, uterine inertia and insufficient force of labour, longer stages of labour, and an external force (obstetric forceps or vacuum) but in contrary to these studies, in our study there showed no clinically significant association between maternal age and neonatal RH.¹²

In regards to birth weight, our study showed that larger birth weight had clinically significant association with retinal haemorrhage. This could be due to the fact that there is greater birth canal resistance during birth. This finding though contradicted to the finding by Pu et al. where full-term infants with low birth weight had higher risk of retinal haemorrhage.¹²

The mean gestational age of the infants with retinal haemorrhage in our study was 39 weeks which is very much comparable to report by Hutcheon et al. where they had the value of 39.5 weeks. Stressing to the fact that greater gestational age specially post-dated new-borns are at greater risk of having RH.¹⁸

There are various other factors which did not show clinically significant association with retinal haemorrhage such as maternal height, maternal smoking and alcohol intake. These negative findings are difficult to interpret since the number of subjects is not large enough, so further prospective studies are needed to investigate the relation between retinal outcome and these risk factors.

CONCLUSION

Our results suggest that spontaneous vaginal delivery, larger birth weight, higher gestational age, birth asphyxia, poor

APGAR score are risk factors for occurrence of neonatal retinal haemorrhage. The presence of retinopathy should be ascertained postnatally by fundus screen.

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