Original Article

Factors associated with delayed reporting of babies for retinopathy of prematurity screening

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Abstract

Background: Retinopathy of prematurity is one of the leading causes of preventable infant blindness worldwide. It may be prevented if at risk infants are screened before occurrence of advanced stages. **Purpose:** To evaluate the factors associated with delayed reporting of babies for retinopathy of prematurity screening. Method: This cross sectional study was conducted in the Department of Vitreo-retina and Pediatric ophthalmology department of National Institute of Ophthalmology and Hospital, Dhaka from December 2019 to October 2021. Total 138 premature babies of ≤34 weeks of gestational age and or ≤1750 gm birth weight were purposively included in the study. Timely reporting was defined as babies come within 30 days of birth and delayed reporting was defined as babies come after 30 days of birth for retinopathy of prematurity screening. All the information was recorded in a pre-designed data collection sheet. **Results:** Among the 138 premature infants 93 (67.4%) babies had timely reporting and 45 (32.6%) babies had delayed reporting for retinopathy of prematurity screening. Majority (n=93, 67.4%) of the premature babies were male child. Out of 138 premature babies, 42 (30.4%) babies had developed retinopathy of prematurity (ROP). Among the 45 babies with delayed reporting, major causes for delay were babies advised for screening but the heath care worker did not mention the time, Parental negligence, Distance, Financial constraint, Nationwide lockdown due to covid-19 pandemic, no advise for screening and sickness of the baby. There was significant difference in the groups regarding maternal education (P<0.001), maternal occupation (P=0.002), residence (P=0.001), gestational age (P=0.010), birth weight (P=0.001), duration in NICU (P<0.001) and referral status (P=0.001). Occurrence of ROP (P=0.002) and Advanced stage (P<0.001) of ROP was significantly more in delayed group. **Conclusion:** Near about one third preterm babies had delayed reporting for retinopathy of prematurity screening where inattention of health care workers, distance of screening center, financial constrain, COVID-19 pandemic, parental negligence and sickness of the baby were the reasons for the delay. Better coordination between the existing centers and increased awareness of the condition, especially appropriate time of referral are recommended.

Keywords: Retinopathy of prematurity, premature infant, screening of ROP.

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Introduction

Retinopathy of prematurity (ROP) is a proliferative disease of the premature developing retina. It is rapidly attaining public health significance in Bangladesh[1] and has been reported to occur in 23.5%– 37.5% of low birth weight[2,3]. It is one of the leading cause of preventable infant blindness worldwide. The incidence of ROP varies widely across different countries and is linked to the socioeconomic developments as well as the quality and accessibility of health care facilities[4]. The incidence of ROP in different regions of the world vary from 7 to 37%[5]. The overall prevalence of ROP and advanced form of disease are significantly higher in infants with late retinal examinations[6]. The prevalence of ROP in Bangladesh was 23.5%-37.5%[2,3]. Increasing rates of preterm births coupled with

better survival rates but lack of uniform quality of neonatal care and delays in diagnosis have led to increasing ROP blindness[7]. This can be prevented by supplemental oxygen, prevention of sepsis, timely screening by a concerted and collaborative effort of neonatologists and ophthalmologists[7]. Typically, retinal vascularization begins at approximately week 16 of gestation, proceeds from the optic nerve head to the periphery, and is completed nasally by approximately 36 weeks of gestation and temporally by 40 weeks of gestation. When this pattern of vascularization is disrupted, ROP may develop. Low gestational age and low birth weight for gestational age are major risk factors for retinopathy of prematurity. Both factors are related to the extent of immaturity of retinal neural and vascular development at birth, and therefore the retinal vulnerability to insult. Furthermore, the lower the gestational age and birth weight, the more profound the loss of factors normally provided by the intrauterine environment for which the immature fetus is unable to take over production. Additionally, low gestational age increases the duration of an infant's exposure to adverse postnatal insults, contributing to the risk of retinopathy of prematurity[8]. Other associated factors includes artificial ventilation for more than 7 days, High volume of blood transfusion. Timely diagnosis and treatment alone can provide excellent visual outcome in most cases, the biggest challenge faced by developing countries today is the lack of timely screening[7]. The main barriers to early screening for ROP were related to availability of trained human resources, ignorance of parents, health care personnel and distance from the point of care[9]. In a study of Bangladesh, total drop out of ROP screening was 15%. The failure to attend in ROP screening was probably due to the parent's fatigability after a long period hospital stay or due to long distance of the residence and financial constraints. Lack of awareness among parents as well as family physicians regarding ROP was also an important cause[3]. In Bangladesh, this study will help to identify the factors responsible for delayed screening. Timely Screening, diagnosis and early treatment can lower the risk for ROP in premature infants with a significant reduction in unfavorable outcome.

Materials & Method

This was an Analytical type of cross sectional study was conducted in the department of Vitreo-retina and Pediatric Ophthalmology department, National institute of Ophthalmology and Hospital, Dhaka from December 2019 to October 2021. A Total of 138 babies fulfilled the selection criteria were included in the study. Babies with gestational age ≤ 34 weeks and or birth weight ≤1750 gram come after 30 days of birth are enrolled as delayed reporting. After enrollment, detailed family and birth history were taken with special attention to maternal education and occupation, residence, gestational age, neonatal sickness, referral status. Cause of delayed reporting was ascertained through open ended question. Quality of referral note was graded as complete or incomplete. Babies who had incomplete information like birth weight, Gestational age, co-existing other congenital or acquired ocular pathology, systemic disease, non-compliant attendant to provide relevant information were excluded from this study. Purpose, procedure, importance and benefit of the study were explained to the parent and informed written consent was taken before data collection. Face to face interview was conducted, while baby was waiting for fundus examination. Retinopathy of prematurity screening was performed by ophthalmologist who was trained in ROP. Indirect ophthalmoscope and VOLK 20 D lens was used for fundus examination. Staging was done as stage 1-5 and APROP as per The International Classification of Retinopathy of Prematurity. If both eye had ROP, then the eye with more advanced stage was counted for analysis. All the information recorded in a pre-designed data collection sheet. After completion of data collection, the data were checked and edited manually and verified before tabulation. Data were coded, entered and analyzed in a computer. The statistical analysis was conducted using SPSS (statistical package for the social science) version 26 statistical software. The findings of the study were presented by frequency, percentage in tables. Mean and standard deviation (for normally distributed data) and Median with Inter-quartile range (IQR) (for skewed data) were used to describe continuous data. Associations of

categorical were assessed using Chi square test, Fisher Exact test and Post hoc analysis. Here, $p<0.05$ was considered significant. Ethical clearance was taken from the Ethical Review Committee (ERC) of National Institute of Ophthalmology and Hospital, Dhaka. Informed written consent was taken from all attendance after adequate explanation of the purpose of the study. They were assured of protection of their autonomy, privacy and confidentiality.

Results

Table 4.1: Distribution of the premature babies by socio-demographic characteristics (N=138)

Baseline characteristics	Frequency (f)	Percentage (%)
Age at reporting (in days)		
Up to 30	93	67.4
31-45	27	19.6
46-60	7	5.1
>60	11	8.0
Median [IQR]	29.5 [28.0-42.0]	
Gender		
Male	93	67.4
Female	45	32.6
Mother's education		
No formal education	9	6.5
Up to primary	47	34.1
Up to SSC	45	32.6
HSC and above	37	26.8
Mother's occupation		
Home maker	99	71.7
Service holder	39	28.3
Residence		
Urban	82	59.4
Rural	56	40.6

Table 4.1 shows that among the 138 premature infants, 93 (67.4%) were from up to 30 days age group and 27 (19.6%) were from 31-45 days age group. Majority (n=93, 67.4%) of the premature babies were male child. Near about one third (n=47, 34.1%) mothers had educational status up to primary level while 99 (71.7%) were homemakers. 82 (59.4%) were urban residence.

Table 4.2: Distribution of the premature babies by birth history and medical condition (N=138)

Characteristics	Frequency (f)	Percentage (%)
Gestational age (in weeks)		
28-32	78	56.5
33-34	60	43.5
Mean ±SD	31.8±2.0	
Birth weight (in gm)		
Up to 1500	64	46.4
> 1500	74	53.6
Mean ±SD	1493.3 ±207.2	
Place of delivery		
Home	13	9.4
Institutional	125	90.6
Neonatal sickness		
Present	130	94.2
Absent	8	5.8
Duration in NICU (n=130)		
1-5	50	38.5
6-10	51	39.2
>10	29	22.3
Median [IQR]	7.0 [3.0-10.0]	
Referral status		
Complete	72	52.2
Incomplete	66	47.8

Table 4.2 shows that 78 (56.5%) premature babies had gestational age from 28-32 weeks where the mean birth weight was 1493.3±207.2 gm. Among the 138 premature babies, 130 babies were in NICU after delivery where the median duration of NICU was 7.0 days. Complete referral regarding screening of retinopathy was found among 72 (52.2%) babies.

Figure 4.1: Distribution of patients by retinopathy of prematurity (ROP) (N=138)
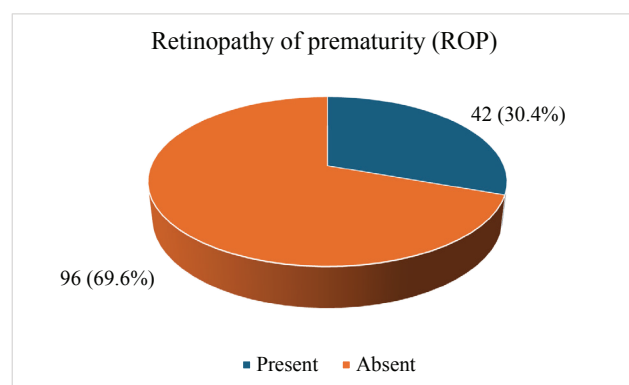

Figure 1 shows that out of 138 premature babies, 42 (30.4%) babies had developed retinopathy of prematurity (ROP) while 96 (69.6%) did not have ROP.

Figure 4.3: Distribution of the premature babies with delayed by cause of delay (N=45)
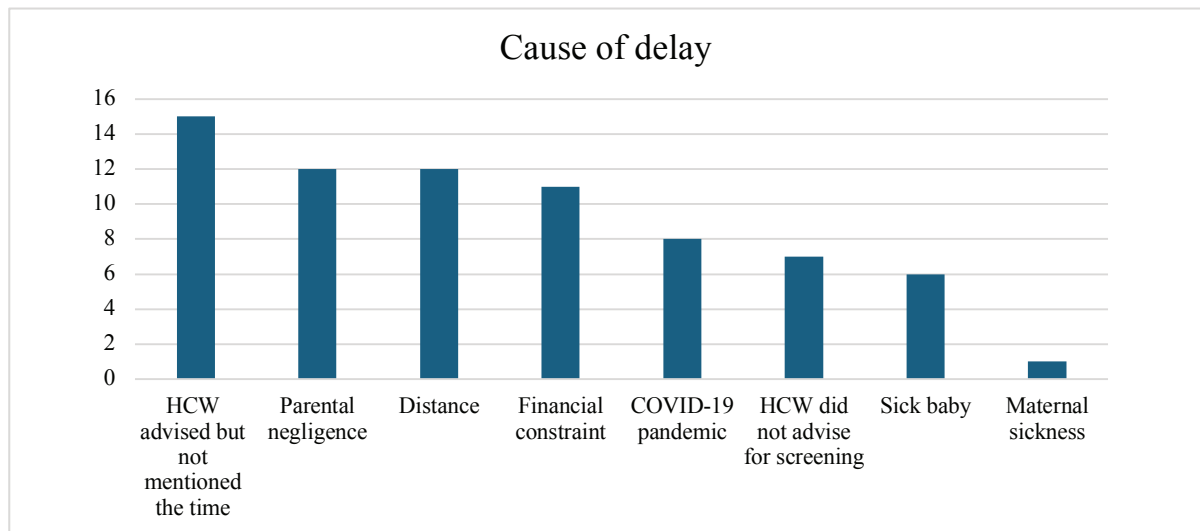

Figure 4.3 shows cause of delayed reporting. Among the 45 babies with delayed reporting, majority (n=15, 33.3%) were advised for screening but the heath care worker did not mention the time. Parental negligence was observed in 12 (26.7%) babies while Distance was the cause of delay for another 12 (26.7%) babies. Financial constraint was the cause of delay for 11 (24.4%) babies. Unfortunately In case of 7 (15.5%) babies, heath care worker did not advise for screening. Due to sickness of baby, screening was delayed for 6 (13.3%) babies. Maternal sickness was the cause of delay for 1 baby.

Table 4.5: Distribution of the patients by retinopathy of prematurity (ROP) and timing of reporting (N=138)

Retinopathy of prematurity (ROP)	Timely reporting	Delayed reporting	*P* value
Present	20 (21.5%)	22 (48.9%)	0.001
Absent	73 (78.5%)	23 (51.1%)	

Chi-square test

Table 4.5 shows that among the 93 premature babies with timely reporting, 20 (21.5%) had retinopathy of prematurity (ROP) while among the 45 premature babies with delayed reporting, 22 (48.9%) had ROP. Chi-square test showed that occurrence of ROP was significantly more among the premature babies with delayed screening as P=0.001.

Table 4.6: Comparison of stage of ROP between timely and delayed reporting groups (N=42)

Stage of ROP	Total	Timely reporting	Delayed reporting	P value
Stage 1	17(40.5%)	13(65.0%)	4 (18.2%)	
Stage 2	5 (11.9%)	3 (15.0%)	2 (9.1%)	
Stage 3	4 (9.5%)	1 (5.0%)	3 (13.6%)	<0.001*
Stage 4	5 (11.9%)	0 (0.0%)	5 (22.7%)	
Stage 5	8 (19.0%)	0 (0.0%)	8 (36.4%)	
APROP	3 (7.1%)	3 (15.0%)	0 (0.0%)	

*Fisher Exact test

Table 4.6 shows that among the 17 premature babies with stage 1 ROP, 13 (65.0%) had timely reporting and 4 (18.2%) had delayed reporting. On the other hand, among the 5 premature babies with stage 4 ROP and the 8 premature babies with stage 5 ROP, all had delayed reporting. In timely reporting group 3 babies had APROP. Fisher Exact test showed that there was significant statistical difference between the groups regarding stage of ROP (P<0.001).

Discussion

Retinopathy of prematurity (ROP) is a proliferative retinal vascular disease affecting the retina of premature infants. The clinical spectrum of ROP varies from spontaneous regression to bilateral retinal detachment and total blindness[7]. Jalali, et al. (2014)[10] showed in a study that Successful treatment depends on robust screening programs that identify and promptly treat premature babies who are likely to develop severe vision-threatening ROP. Late disease reporting is indeed the most common cause of failed treatment and ROP blindness. This cross sectional study was conducted among 138 premature babies ≤34 weeks gestational age and or ≤1750 gm birth weight to evaluate the factor associated with delayed reporting for retinopathy of prematurity screening. Among the 138 premature infants, 67.4% were from up to 30 days age group and 19.6% from 31-45 days age group and 8% were from >60 days age group.

Out of 138 premature babies, 42 (30.4%) babies had developed different stages of retinopathy of prematurity (ROP). Bhuiyan, et al.[3] conducted a study among very low birth weight infants admitted in NICU, BSMMU reported the overall frequency of ROP was 23.5%). Saha, et al.,[2] conducted a study about incidence of retinopathy of prematurity (ROP) in Neonatal Unit of Dhaka Shishu (Children) Hospital (DSH) was determined 35.0%. Another study performed by Nag, et al.,[11] in National Institute of Ophthalmology found the prevalence of ROP was 37.5%. Nahar, et al.[1] observed that about a third of babies had different stages of ROP. In India, Nikhil, et al.,[12] showed prevalence of ROP in preterm infants was 19.2%. Out of the 138 premature babies, 45 (32.6%) premature babies had delayed screening of ROP while 93 (67.4%) babies had timely screening. When the causes of delay were evaluated, it was observed that majority of babies 15 (33.3%) were advised for screening but the heath care worker did not mention the time for screening. Parental negligence was observed in 12 (26.7%) babies while Distance was the cause of delay for another 12 (26.7%) babies. Financial constraint was the cause of delay for 11 (24.4%) babies. Nationwide lockdown due to covid-19 pandemic causes delay in screening for 17.8% babies. Unfortunately in case of 7 babies (15.5%), heath care worker did not advise for screening. Due to neonatal sickness screening was delayed for 13.3% babies while maternal sickness causes delay in one baby. Nahar, et al.[1] reported that lack of adequate trained human resources, infrastructure and equipment are major challenges for screening of ROP in Bangladesh. In India, Gopal, et al[13] showed major Reasons for delayed reporting were not asked to do so/no referral from pediatrician in 46% participants and unaware of the importance by 33% participants. Padhi, et al [9] found that the main barriers to early screening for ROP were related to availability of trained human resources, ignorance of parents and health care personnel and distance from the point of care. These data showed the importance of creating awareness about timely screening and referral guidelines among all stakeholders. The pediatricians should effectively communicate the need for timely screening and referral guidelines with the parents. The stakeholders include pediatricians, parents, neonatal nurses, ophthalmologists, and also family physicians and the public at large[13].

The present study found no gender influence regarding time of screening which matched the study of Gopal, et al.[13] In the timely reporting group 32 (34.4%) babies had mother with educational status HSC and above while in the delayed reporting group only 5 (11.1%) babies had mother with educational status HSC and above. Post hoc analysis showed that this difference was significant between up to primary level group (p=0.002) and HSC & above group (p=0.0037). Again, in the timely reporting group 59 (63.4%) babies had mothers who were home makers while in the delayed reporting group 40 (88.9%) babies had mothers who were home

makers. The main explanation for the connection between maternal education and child health is that, education provides women with more knowledge of and commitment to appropriate health practices[14]. Moreover, educated mothers are more empowered to make decisions on the use of health care services and adequate utilization of preventive and therapeutic health services which have higher impact on children health[15]. Timely reporting group 68.8% babies were from urban areas while in the delayed reporting group 40.0% babies were from urban areas. Similar finding was presented by Gopal, et al.[13] The better access to health care facilities and might be reason of timely screening in urban area[15]. Preterm babies with lower gestational age and birth weight had significantly more delay compared to others. Gopal, et al[13] showed Lower gestational age and low birth weight seems to be the factors associated with delayed reporting for ROP screening. In delayed reporting group, 15 (33.3%) babies stayed more than 10 days in NICU. Infants not screened for ROP in the NICU had greater risk for missing follow-up care compared to infants who had their first retinal examination in the NICU[16]. So, NICU based ROP screening program is time demand. In delayed reporting group, incomplete referral was observed in 75.6% babies while in timely reporting group it was 34.4%. Mousavi, et al.[6], showed their study where proper recommendation was not offered to the parents for retinal examination of their premature baby in about 38.7%. In this study, occurrence of ROP was significantly more common among the premature babies with delayed reporting (48.9%) compared to early reporting group (21.5%) (P=0.002). Out of the 42 babies with ROP, 40.5% had stage 1 ROP, 5 (11.9%) had stage 4 ROP, 8 (19.0%) had stage 5 ROP and 7.1% had APROP. The study of Nahar, et al.[1] found that stages 1 and 2 constituted 45% of the ROP cases, stage 3 was 23%, stage 4 was 5% and stage 5 was 9%. On the other hand, Bhuiyan, et al.[3] found among the ROP cases, 13% had stage 1 ROP, 8% had stage 2 ROP, 42.1% had stage 3 and remaining 36.8% neonates had APROP. The difference of observation might be due to the inclusion of very low birth weight infants admitted in NICU.

In this study, stage 1 ROP and APROP was significantly more in timely reporting group while

stage 4 and 5 in delayed reporting group. Azad, et al. 17 found most of the stage 5 retinopathy of prematurity due to lack of screening. The natural course of ROP offers a narrow window of opportunity for the treatment. Jalali, et al.10 recommended that screening at a median age of less than 1 month of birth had a substantially better impact on stage at reporting being less than 4, ability to offer treatment and good to fair final anatomical outcomes with minimal of poor outcomes. A Bangladeshi study showed treatment requiring ROP was 18.0%, where laser/intra-vitreal injection was assigned for type 1 disease and pars plana vitrectomy was assigned for stage 4 and stage 5 ROP 2.

Conclusion

The present study revealed that there were notable gaps in timely referral and ROP screening. Near about one third premature babies had delayed reporting for retinopathy of prematurity screening where inattention of health care workers, distance of screening center and parental negligence were the major concern. Lower socio-economic status including maternal education and occupation were found to be related with delayed reporting. Occurrence of retinopathy of prematurity and advanced stages was significantly more common among the premature babies with delayed reporting.

Recommendations

A multicenter study should be conducted which includes a large number of participants to get a more vivid picture of the situation. NICU based screening of retinopathy of prematurity should be established. Nationwide attempts to improve public awareness along with clear instruction to health care worker for the referral of premature infants for timely screening is recommended.

Limitations of the study: Questionnaire for data collection was not validated in a pilot study. Multiple factor has taken into account but which one is the main cause for delay was not evaluated by logistic regression analysis. Single tertiary institute study may not be representative of other major regions across the country. Paternal education and occupation were not taken into consideration that may make the study less informative.

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