Retinopathy of Prematurity Screening in a Tertiary Care Centre

Miloni Suketu Shah¹, Ajit Gulabrao Khune²* and Dhiraj Namdeo Balwir³

¹PG Resident, Department of Ophthalmology, Dr. Vasantrao Pawar Medical College and Hospital, Research Centre, Nashik – 422003, Maharashtra, India; miloni445@gmail.com
²Associate Professor, Department of Ophthalmology, Dr. Vasantrao Pawar Institute of Medical Sciences and Research, Nashik – 422003, Maharashtra, India; ajitkhune@yahoo.com
³Professor and HOD, Department of Ophthalmology, Dr. Vasantrao Pawar Medical College and Hospital, Research Centre, Nashik – 422003, Maharashtra, India; dheeraj_balwir@yahoo.com

Abstract

Background: To conduct an effective ROP screening program according to the Indian standard needs and to identify the infants who could benefit from treatment and make appropriate recommendations on the timing of future screening.

Aims and Objectives: To estimate the incidence of ROP among Premature infants.

Materials and Methods: A Prospective Observational study of 2 years in which 170 patients were screened with following criteria: GA at birth of ≤35 weeks, BW <1700 gms, exposed to oxygen >30days, other factors that can increase the risk of ROP and where screening should be considered are premature babies >37 weeks and >1700gms but with the first screening was done within 4 weeks (30 days) of life in infants with age >28 weeks of GA, 2-3 weeks after birth if GA <28 weeks or BW is <1200gms.

Results: Out of the 170 babies screened 35 babies had ROP. Incidence of ROP in our study was 20.59%. The sensitivity of AAP and UKRCPCCH guidelines to ours were 77.14% and 60% respectively.

Conclusion: ROP may be seen in heavier and larger babies in India that have consequently a shorter window period for development of ROP, Hence, a criteria screening even larger babies should be taken into consideration.

Keywords: Birth Weight, Gestational Age, Retinopathy of Prematurity, Screening

1. Introduction

Retinopathy of Prematurity (ROP), seen in the premature and low BW infant is a vaso proliferative disorder of the developing retinal vasculature and is a potentially blinding condition. Retinopathy of Prematurity was called as Retrolental Fibroplasia (RLF) in 1940's. The term RLF was coined in the year 1942 by Terry. Term ROP was coined by Heath in 1951.

The retina is unique tissue in that it has no blood vessels until the fourth month of gestation. Normal retinal vascularization happens centrifugally from optic disc to ora. Vascularization up to nasal ora is completed by 8 months (36 weeks) and temporal ora by 10 months (39–41 weeks). The course of ROP may range from minimal sequelae to bilateral, irreversible and total blindness in more advanced cases. It is an avoidable cause of blindness.

Incidence of this condition is rising rapidly in developing countries who have just started to feel the burden of ROP with gradual improvement in neonatal care and awareness.

The World Health Organization's “Vision 2020 programme” has identified ROP as an important cause of blindness in both high and middle income countries. Approximately 2 million babies out of 26 million annual live births in India are born with BW <2000g and are at
risk of developing ROP. WHO estimates that there are 15 million preterm births a year (born at <37 weeks) and India has the largest number of preterm births in the world.

The incidence of ROP is increasing in India because of improved neonatal survival rate. In India the incidence of ROP is between 38 and 51.9% in low birth infants.

The most important determinant of any ROP management program is an effective screening strategy. The goal of an effective ROP screening program is to identify the infants who could benefit from treatment and make appropriate recommendations on the timing of future screening and treatment interventions.

Very few comprehensive review articles covering all the aspects of ROP are published. Hence the present study was undertaken to screen the premature infants for ROP which if untreated may cause severe visual disability. Knowing the relationship between the causative factor and ROP will help in prevention and reducing the incidence of ROP.

2. Aims and Objectives

1. To estimate the incidence of ROP among premature infants.
2. To classify or grade ROP based on ICROP Classification.

3. Materials and Methods

Study Type: Prospective observational study.

Study Settings: Department of Ophthalmology of Dr. Vasantarao Pawar Medical College and Research Centre.

Study Duration: August 2016 to September 2018.

Study Population: All the infants fitting into the Inclusion criteria admitted in our NICU and also those referred from outside attending our OPD were screened from August 2016 - September 2018.

Eligibility Criteria

Selection of Subjects
All neonates weighing <1700 gm and/or with a gestation ≤35 weeks admitted to NICU of our Tertiary Care Centre and also those referred from outside attending our OPD were routinely screened for ROP between the year August 2016 - September 2018.

All relevant perinatal data including risk factors (exposure to oxygen, days of oxygen exposure, sepsis, anaemia and blood transfusion, phototherapy, apnea, congenital cardiac defect, Patent Ductus Arteriosus (PDA), intraventricular haemorrhage, ventilation, days on ventilation, history of RDS, multiple birth, pneumonitis.

Inclusion Criteria
- Gestational Age (GA) at birth of <34-35 weeks
- Birth Weight (BW) <1700 g
- Exposed to oxygen >30 days
- Other factors that can increase the risk of ROP and where screening should be considered are premature babies >37 weeks and >1700 g but with
  3. Respiratory Distress Syndrome
  4. Sepsis
  5. Sickly survivors
  6. Pneumonitis
  7. Multiple blood transfusions
  8. Multiple births(twins/triplets)
  9. Apnoeic episodes
  10. Intraventricular haemorrhages

Exclusion Criteria
- Babies with Congenital anomalies of eye
- Babies with chorioretinitis
- Infants born after 36 weeks (excluding the above causes)
- BW >1700 g (excluding the above causes)

Methodology
- Informed consent was taken from the parents/guardian.
- IEC approval was taken.
- Patients were chosen according to the inclusion and exclusion criteria.
- Detailed maternal history and neonatal history was taken.
- All infants were screened by the same ophthalmologist.

Time of Screening
The first screening was done within 4 weeks (30 days) of life in infants with age >28 weeks of GA, 2-3 weeks after birth if GA is <28 weeks or BW is <1200g.
Examination
- Screening was done under a radiant warmer in the NICU, under the guidance of the neonatologist. Discharged and stable babies were screened in the OPD. Parents/Guardians were informed before the examination about the procedure of screening and after their consents the infants were screened. Pupils were dilated using diluted Tropicacyl plus (0.5% tropicamide plus 2.5% phenylephrine) eye drops in 1:2 dilution using distilled water 2-3 times about 10-15 minutes apart or till full dilatation occurs. Care was taken to wipe off the excess drops to prevent systemic absorption though the cheek skin as over dosage carries the risk of tachycardia and hyperthermia.
- Topical anaesthesia 2% proparacaine drops was instilled. A pediatric wire speculum was used to keep the eyes apart. Gentle indentation with a pediatric scleral depressor was used to stabilize the globe.
- A detailed Anterior segment examination was done

Posterior Segment Evaluation
- Fundus evaluation: By Heine Indirect ophthalmoscopy with a VOLK condensing lens of +28D
- Follow up schedule for ROP Babies:

| Zone of Retinal Findings | Stage of Retinal Findings | Follow Up Interval |
|--------------------------|---------------------------|--------------------|
| ZONE I                   | Immature vascularisation  | 1-2 weeks          |
|                          | Stage I or II             | 1 week or less     |
|                          | Regressing ROP           | 1-2 weeks          |
| ZONE II                  | Immature vascularisation | 2-3 weeks          |
|                          | Stage I                  | 2 weeks            |
|                          | Stage II                 | 1-2 weeks          |
|                          | Stage III                | 1 week or less     |
|                          | Regressing ROP           | 1-2 weeks          |
| ZONE III                 | Stage I or II            | 2-3 weeks          |
|                          | Regressing ROP           | 2-3 weeks          |

Retinal examination was terminated based on postmenstrual age or retinal findings. Examination was terminated when

1. Full retinal vascularization was noted which was usually completed around 40-45 weeks.
2. Regression of ROP noted.

The babies were screened every 1-2 weeks at least until the infant is 38-40 weeks of postmenstrual age.

Statistical Analysis
A SPSS software was used for all statistics A P value <0.05 was considered as statistically significant.

4. Results
During the study period of 2 years from August 2016 - September 2018 the total number of babies screened were 177.

Out of the 177 babies that we screened 170 babies were included in our study. 116 males (68.24%) and 54 Females (31.76%). The birth mean BW of the babies in our study was 1590g ± 368.19g (Range: 898-3000g). Mean GA of the babies in our study was 33.38±2.8 weeks (Range: 25-41 weeks).

35 of the 170 babies had ROP. Thus, the incidence of ROP in our study was 20.59%.

ROP Data: Initial examination was done between 3 and 7 weeks with an average of 4 weeks. Late screening may be due to delayed referral of the baby from outside or late admission in our NICU and failure to screen outside.

Total males with ROP were 26 (74.28%), females with ROP 9 (25.71%) (p<0.05).

First Detection of ROP: 23(65.71%) babies had ROP in 1st screening. 1/25 baby had AP ROP and was lasered the same day. In 12(34.28%) babies the peripheral retinal was avascular which then developed ROP. 1/12 babies had later developed Plus disease. The mean BW at 1st detection of ROP was 1557.14 grams and average Post Conceptional Age was 37.08 weeks.

Incidence and Severity of ROP in Relation to BW: The mean BW of NON ROP babies was 1606.58±375.92 g. Mean BW of ROP babies was 1528.94±334.59 g (range: 898-2750 g) [p<0.05]. Incidence of ROP in BW ≤ 1250 g was 30.7%. Incidence of ROP in BW >1251g was 18.7% (p<0.05). Thus, ROP was significantly associated with BW (table 1).

| BW       | Total Babies | ROP Negative Eyes (N=270) | ROP Positive (Eyes)(N=70) |
|----------|--------------|----------------------------|----------------------------|
| ≤ 1000   | 5            | 8(2.9%)                    | 2(2.8%)                    |
| 1001-1250| 21           | 28(10.3%)                  | 14(20%)                    |
| 1251-1500| 57           | 90(33.33%)                 | 24(34.2%)                  |
| 1501-1750| 46           | 74(27.4%)                  | 18(25.57%)                 |
| 1751-2000| 27           | 46(17.03%)                 | 8(11.42%)                  |
| >2001    | 14           | 24(8.8%)                   | 4(5.7%)                    |

Table 1. Distribution of ROP babies according to BW 8%
Incidence of ROP in relation to GA at Birth: Mean GA at birth of NON ROP babies was 33.91±2.81 week. Mean GA at birth of ROP babies was 32.31±2.38 weeks, (range 26-39 weeks). (p<0.05). Incidence of ROP ≤32 weeks was 33.92%. Incidence of ROP >32 weeks was 13.91% (p<0.05%). Thus, ROP was found to be significantly associated with GA (table 2).

### Table 2. Distribution of ROP according to GA at birth

| GA in Weeks | Total Babies | ROP Negative Eyes (N=270) | ROP Positive Eyes (N=70) |
|-------------|--------------|---------------------------|--------------------------|
| ≤28         | 13           | 20(7.4%)                  | 6(8.5%)                  |
| 29-30       | 10           | 12(4.44%)                 | 8(11.4%)                 |
| 31-32       | 33           | 42(15.5%)                 | 24(34.28%)               |
| 33-34       | 61           | 96(35.5%)                 | 26(37.14%)               |
| 35-36       | 27           | 50(18.51%)                | 4(5.71%)                 |
| 37-38       | 21           | 42(15.5%)                 | 0                        |
| 39-40       | 4            | 6(2.2%)                   | 2(2.8%)                  |
| >40         | 1            | 2(0.7%)                   | 0                        |

4.1 Asymmetry
Out of 35 ROP babies (70 eyes), 3 babies (6 eyes) had asymmetrical disease. None of the babies in our study had unilateral presentation.

4.2 Data according to the Stages
21 (30%) eyes had Stage I, 18 eyes (25.7%) had Stage II, 27 eyes (38.6%) had Stage III, 2 eyes (2.8%) had Aggressive Posterior ROP and 2 eyes (2.8%) had Plus disease. The BW and GA at birth were inversely proportion (table 3).

### Table 3. Distribution of mean BW and GA according to the stages of ROP seen

| Stage | Mean BW (Grams) | Stage III, Plus Disease and AP ROP |
|-------|----------------|----------------------------------|
| Stage I | 1660±428     | 1435.5±309.7                     |
| Stage II | 1567.5±238.8 |                                  |
| Stage III, Plus Disease and AP ROP | 31.56±2.56 |                                  |

4.3 Zone Distribution
4 eyes (5.71%) had ROP in Zone I, 14(20%) eyes had ROP in Zone II and 52(74.28%) eyes had ROP in Zone III. Maximum cases in our study was seen in Zone III.

4.4 Neonatal Risk Factors
Various neonatal risk factors were studied of which O\textsubscript{2} exposure, number of days of O\textsubscript{2} exposure, Ventilation, number of days on ventilation, RDS, Sepsis, Blood transfusion, Apnoea using Chi-Square test were significant indicating an increased association of ROP. (table4).

### Table 4. Details of the risk factors

| Neonatal Risk Factors | Non ROP Babies N=135 | ROP Babies N=35 | P Value | Significance |
|-----------------------|-----------------------|-----------------|---------|-------------|
| O\textsubscript{2} Exposure | 85 | 32 | 0.00119 | Significant |
| Average No of Days of O\textsubscript{2} Exposure | 8.152 | 33.09 | 0 | Significant |
| Ventilation | 11 | 9 | 0.00404 | Significant |
| Average No of Days of Mechanical Ventilation | 2.18 | 8.44 | 0.009 | Significant |
| Phototherapy | 25 | 6 | 0.8510 | Not Significant |
| Multiple Birth | 28 | 5 | 0.389 | Not Significant |
| RDS | 57 | 26 | 0.00072 | Significant |
| Sepsis | 28 | 18 | 0.00021 | Significant |
| Sickly Survivors | 30 | 7 | 0.776477 | Not Significant |
| Pneumonitis | 33 | 8 | 0.844 | Not Significant |
| Blood Transfusion | 18 | 10 | 0.0303 | Significant |
| IVH | 1 | 1 | 0.3007 | Not Significant |
| Apnea | 12 | 11 | 0.00051 | Significant |

For Multivariate Analysis we applied Binary Logistic Regression analysis. We found that the number of days of O\textsubscript{2} exposure and Sepsis was a significant risk factor. Analysis showed that increasing day of O\textsubscript{2} exposure is associated with an increased likelihood of ROP. Also, it suggested that the odds of having ROP was 26.26 times greater for those having sepsis as opposed to those not having sepsis (table 5).
Using the current American screening guidelines (≤1500g BW or ≤32 weeks GA) 8 babies (22.85%) would have been missed.

So out of total 31 eyes of 16 babies (one baby had only one eyed lasered) that were lasered, 4 eyes of 2 babies (12.9%) would have been missed if AAP guidelines were used. Thus, the Sensitivity of AAP guidelines was 77.14%

If the UK Royal College of Paediatrician and Child Health (UKRCPCH) would have been used an additional 6 babies would have been missed.

So out of total 31 eyes of 16 babies (one baby had only one eyed lasered) that were lasered, 11 eyes of 6 babies (68.75%) would have been missed if BRITISH GUIDELINES were used.

Thus, the sensitivity of British Guidelines was 60%.

### 5. Discussion

The increasing incidence of prematurity and better survival of smaller babies has led to an increase in the incidence of ROP. Hence an attempt was made in current study to look at the incidence of ROP in a rural based Tertiary Care Centre.

In the present study, a total of 170 babies were screened in detail.

#### 5.1 Screening

The first screening was done within 4 weeks (30 days) of life in infants with age >28 weeks of GA. Screening was done earlier (2–3 weeks after birth) if GA was <28 weeks or BW is <1200 g.

The onset of serious ROP correlates better with Postmenstrual age (GA at birth plus chronologic age) than with Postnatal age. That is, the more preterm an infant is at birth, the longer the time to develop serious ROP. This knowledge has been used previously in developing a screening schedule.

According to the AAP Examination should be performed between 4 and 6 weeks’ postnatal age or between 31 and 33 weeks’ postconceptional age.

Jalali et al., also NNF 2010 suggest that the screening in Indian babies especially the larger and heavier babies who have a shorter period of development of ROP should be screened earlier at least first screening should begin within 4 weeks of GA if >28 weeks and within 2-3 weeks if GA <28 weeks or BW <1200 grams.

#### 5.2 Incidence

In our present study the incidence of ROP was 20.59%. Incidence of severe ROP (all which required treatment) was 9.41%. International studies suggest incidence of ROP ranges from 10–45%. In India, approximately, the incidence of ROP is reported between 24% and 47%.

The incidence in our study was on the lower side of the range found in India. This might probably be due to the fact that the neonatal care centre in our hospital provided controlled delivery of oxygen to the premature at-risk babies. Incidence in our study was similar to that
found in study done by Maheshwari et al., Krishnarao et al., Chaudhari et al.

5.3 Mean BW and GA
Mean BW of the babies in our study was 1590g ± 368.19g (range 898-3000 g). The mean BW of NON ROP babies was 1606.58 ± 375.92 g. Mean BW of ROP babies was 1528.94±334.59 g, (range: 898-2750 g).

Mean GA of the babies in our study was 33.38±2.8 weeks (range 25-41 weeks). Mean GA of NON ROP babies was 33.91±2.81 weeks. Mean GA of ROP babies was 32.31±2.38 weeks, (range: 26-39).

This study suggested that the babies were heavier and older than the American screening cut-off. This was supported by a study done by Hungi et al. in which the mean BWs and periods of gestation with and without ROP were 1555.9 vs. 1672.5 g and 32.2 vs. 34.6 weeks, respectively. Also, a study done by Sundar KC et al. also found that the mean BW of babies with and without ROP identified in their study was 1480 grams and 1620 grams respectively. The mean GA of babies with and without ROP was 32 weeks and 33 weeks respectively.

However, many Indian studies as well as International studies have not supported the fact that ROP does occur in heavier and older babies.

5.4 First Detection of ROP
23/35 (65.71%) babies had ROP in 1st screening. In 12/35 (34.28%) babies the peripheral retinal was avascular which then developed ROP. The average BW of all ROP babies at first detection was 1557.14 g. Average Post Conceptional Age at first detection of all ROP was 37.08 weeks.

Higgins et al. reported that most severe stage was reached at an average of 35.3±2.7 weeks range 31-41 weeks. This was somewhat similar to our study. Rekha et al. stated that the maximum stage of ROP developed between 37-42 weeks post conceptional age.

5.5 Incidence and Severity of in Relation to BW and GA
In our study Incidence of ROP ≤1250 g was 30.7% and those >1251g was 18.7%. Incidence of ROP ≤32 weeks was 33.92% and >32 weeks was 13.91%.

Gupta et al. in their study found the incidence of ROP was 33.3% in babies ≤32 weeks gestation and 36.4% in babies weighing ≤1250 gm. Parekh et al. found the incidence of ROP in infants ≤1250gm was 55.1% and >1250 gm was 16% and the incidence of GA out was 88.6% in ≤32 weeks and (11.4%) in >32 weeks. However, Wright et al. published a study that focused on the incidence of larger infants. In that study, no infant with a BW ≥1200g or with a PMA of ≥30 weeks developed Threshold ROP which is in complete contrast of our study.

5.6 Stage-wise Distribution of ROP
21(30%) eyes had Stage I, 18 eyes (25.7%) had Stage II, 27 eyes (38.6%) had Stage III, 2 eyes (2.8%) had Aggressive Posterior ROP and 2 eyes (2.8%) had Plus disease. The mean BW was 1660±428 g for Stage I, 1567.5±238.8 g for Stage II and 1435.5±309.7 grams for Stage III. The mean GA was 32.4±1.58 weeks for Stage I, 33.55±2.51 weeks for Stage II and 31.56±2.56 weeks for Stage III.

We noticed as the Stage of ROP increased the average BW decreased. This was similarly noticeable by Charan, Dogra et al.

5.7 Zone Distribution of 70 Eyes
2(2.8%) eyes had ROP in Zone I, 14(20%) eyes had ROP in Zone II and 54(77.1%) eyes had ROP in ZONE III. Few babies in Zone I may be due to regular screening and early identification of all severe ROP and also may be due to poor survival rate of very low BW infants.

Crystal Le et al. in their study found out patients with ROP most commonly in ZONE III (68%) and zone II was the second most common (26%) and only one case was noted in Zone I. Also, Alajbegovic-Halimic et al. stated in their study that the babies with ROP was most commonly found to have ROP in Zone III (62.5%). 31.3% of babies had ROP in zone II and 6.3% of babies had ROP in Zone I.

5.8 Neonatal Risk Factors
We investigated role of O₂, number of days of O₂ exposure, mechanical ventilation, number of days mechanical ventilation, RDS, sepsis, sickly survivors, phototherapy, IVH, pneumonitis, blood transfusion, apnoea and multiple birth in ROP.

Applying Chi Square test of significance on Univariate analysis O₂ exposure, number of days of O₂ mechanical ventilation, number of days on mechanical ventilation, RDS, sepsis, blood transfusion and apnoea were found to be significant.
Applying **Binary Logistic Regression** multivariate analysis showed Number of days on O₂ and Sepsis were statistically significant. A detailed study of O₂ exposure in our study revealed that the average number of days on O₂ in ROP babies was 33.09 days and that in NON ROP babies was 8.152 days.

Andrea Moraes et al. in their study found on bivariate analysis found pulmonary disease, sepsis, APGAR score at 1 min and 5 mins, blood transfusion and average days on mechanical Ventilation was statistically significant. The average number of days on O₂ therapy in ROP babies was 27 days (range: 0-150 days) and NON ROP babies was 6 days (range: 0-150 days). In treated ROP it was 41 days (range: 2-150 days) and non-treated ROP was 8 days (range: 0-150 days). On Logistic regression analysis the found Pulmonary disease was a statistically significant risk factor.

Krishna A Rao et al. found surfactant administration, apnoea, sepsis, Intermittent positive pressure ventilation and blood transfusion and for severe ROP RDS, surfactant administration, apnoea, hours of O₂ and Blood transfusion as risk factors on Univariate analysis and on multivariate only GA and BW were risk factors for ROP and IVH for severe ROP. They also investigated the O₂ exposure duration was in hours and they found that the ROP babies had an exposure of average 29 hours to that in NON ROP babies which was 23.5 hours. They did not find any statistical significance in the exposure of O₂ for development of ROP.

6. Conclusion

It is not uncommon that ROP in India does occur in larger and heavier babies. Moreover, these babies have a very short window period for development of ROP. An early identification of these heavy babies at risk for developing severe ROP would help to reduce the burden of blindness associated with Retinopathy of Prematurity.

We require a more definitive guideline rather than a discretionary one to include more and more babies so as to not miss out on any babies with ROP and to limit the burden of blindness caused by ROP.

For current scenario, the cut off for BW and GA need to be higher and a regionalisation of the screening criteria needs to evolve. Since our sample size was small a much larger study is required for confirming our findings.

7. References

1. Terry TL. Extreme prematurity and fibroblastic overgrowth of persistent vascular sheath behind each crystalline lens. I. Preliminary report. Am J Ophthalmol. 1942; 25:203–4. https://doi.org/10.1016/S0002-9394(42)92088-9
2. Heath P. Pathology of retinopathy of prematurity, RLF. Am J Ophthalmol. 1951; 34:1249–68. https://doi.org/10.1016/0002-9394(51)91859-4
3. Pejawar R, Vinekar A, Bilagi A. National neonatology foundation’s evidence-based clinical practise guidelines. Retinopathy of Prematurity, NNF India, New Delhi; 2010. p. 253–62.
4. Howson CP, Kinney MV, Lawn JE. March of dimes, PMNCH, save the children, WHO. Born too soon: The global action report on preterm birth. Geneva: World Health Organization; 2012.
5. Jalali S, Anand R, Kumar H, Dogra MR, Azad R, Gopal L. Programme planning and screening strategy in retinopathy of prematurity. Indian J Ophthalmol. 2003; 51(1):89–99.
6. Palmer EA, Flynn JT, Hardy RJ, et al., The Cryotherapy for Retinopathy of Prematurity Cooperative Group. Incidence and early course of retinopathy of prematurity. Ophthalmology. 1991; 98(11):1628–40. PMID:1800923
7. American Academy of Pediatrics. Section on ophthalmology. Screening examination of premature infants for retinopathy of prematurity. Pediatrics. 2005; 117:572–6. https://doi.org/10.1542/peds.2005-2749. PMid:16452383
8. LIGHT-ROP Cooperative Group. The design of the multicenter study of light reduction in retinopathy of prematurity (LIGHT-ROP). J Pediatr Ophthalmol Strabismus. 1999; 36(5):257–63. PMID:10505830
9. Hutchinson AK, Saunders RA, O’Neil JW, Lovering A, Wilson ME. Timing of initial screening examinations for retinopathy of prematurity. Arch Ophthalmol. 1998; 116(5):608–12. https://doi.org/10.1001/archophthalmol.116.5.608. PMid:9564946
10. Fierson WM, Palmer EA, Biglan AW, Flynn JT, Petersen RA, Phelps DL. Screening examination of premature infants for retinopathy of prematurity. A Joint Statement of the American Academy of Pediatrics the American Association for Pediatric Ophthalmology and Strabismus the American Academy of Ophthalmology, American Academy of Pediatrics Section on Ophthalmology, Retinopathy of Prematurity Subcommittee, 1990 to 1996. Pediatrics. 1997 Aug; 100(2):273–4. https://doi.org/10.1542/peds.100.2.273
11. Murthy KR, Murthy PR, Shah DA, Nandan MR, Niranjan HS, Benakappa N. Comparison of profile of retinopathy of prematurity in semi urban/rural and urban NICUs in Karnataka, India. Br J Ophthalmol. 2013; 97:687–9. Back to cited text no. 5. https://doi.org/10.1136/bjophthalmol-2012-302801. PMid:23603485
12. Hungi B, Vinekar A, Datti N, Kariyappa P, Braganza S, Chinnaiah S, et al. Retinopathy of prematurity in a rural Neonatal Intensive Care Unit in South India - A prospective study. Indian J Pediatr. 2012; 79:911–5. https://doi.org/10.1007/s12098-012-0707-y. PMid:22359197

13. Sundar KC, Meenakshi KD, Patil AB. A retrospective study on the risk factors for retinopathy of prematurity in NICU of tertiary care hospital. Int J Contemp Pediatr. 2018; 5:1447–51. https://doi.org/10.18203/2349-3291.ijcp20182544

14. Ahuja AA, V Reddy YC, Adenuga OO, Kewlani D, Ravindran M, Ramakrishnan R. Risk factors for retinopathy of prematurity in a district in South India: A prospective cohort study. Oman J Ophthalmol. 2018; 11(1):33–7.

15. Alajbegovic-Halimic J, Zvizdic D, Alimanovic-Halilovic E, Dodik I, Duvnjak S. Risk factors for retinopathy of prematurity in premature born children. Med Arch. 2015; 69(6): 409–13. https://doi.org/10.5455/medarh.2015.69.409-413. PMid:26843736 PMcid:PMC4720470

16. Parekh A, Behera M, Kulkarni S, Narwadkar P, Natu S. Retinopathy of prematurity: A study of incidence and risk factors. Int J Contemp Pediatr. 2016; 3:1320–5. https://doi.org/10.18203/2349-3291.ijcp20163669

17. Higgins RD, Mendelsohn AL, DeFeo MJ, Ucel R, Hendricks-Munoz KD. Antenatal dexamethasone and decreased severity of retinopathy of prematurity. Arch Ophthalmol. 1998; 116:601–5. https://doi.org/10.1001/archophthalm.116.5.601. PMid:9596495

18. Rekha S, Battu RR. Retinopathy of prematurity: Incidence and risk factors. Indian Pediatr. 1996; 33:999–1003.

19. Gupta VP, Dhaliwal U, Sharma R, Gupta P, Rohtagi J. Retinopathy of prematurity - risk factors. Indian J Pediatr. 2004; 71:887–92. https://doi.org/10.1007/BF02830827. PMid:15531829

20. Parekh A, Behera M, Kulkarni S, Narwadkar P, Natu S. Retinopathy of prematurity: A study of incidence and risk factors. Int J Contemp Pediatr. 2016; 3:1320–5. https://doi.org/10.18203/2349-3291.ijcp20163669

21. Charan R, Dogra MR, Gupta A, Narang A. The incidence of retinopathy of prematurity in a neonatal care unit. Indian J Ophthalmol. 1995; 43:123–6.

22. Le C, Basani LB, Zurakowski D, Ayyala RS, Agraharam SG. Retinopathy of prematurity: Incidence, prevalence, risk factors, and outcomes at a tertiary care center in Telangana. J Clin Ophthalmol Res. 2016; 4:119–22. https://doi.org/10.4103/2320-3897.190785

23. Alajbegovic-Halimic J, Zvizdic D, Alimanovic-Halilovic E, Dodik I, Duvnjak S. Risk factors for retinopathy of prematurity in premature born children. Med Arch. 2015; 69(6): 409–13. https://doi.org/10.5455/medarh.2015.69.409-413. PMid:26843736 PMcid:PMC4720470

24. Freitas AM, Mörschbächer R, Thorell MR, Rhoden EL. Incidence and risk factors for retinopathy of prematurity: A retrospective cohort study. Int J Retina Vitreous. 2018 May 31; 4:20. https://doi.org/10.1186/s40942-018-0125-z. PMid:29881640 PMcid:PMC5984384

25. Rao KA, Purkayastha J, Hazarika M, Chaitra R, Adith KM. Analysis of prenatal and postnatal risk factors of retinopathy of prematurity in a tertiary care hospital in South India. Indian J Ophthalmol. 2013; 61(11):640–4. https://doi.org/10.4103/0301-4738.119347. PMid:24145565 PMCid:PMC3959079

How to cite this article: Shah MS, Khune AG and Balwir DN. Retinopathy of Prematurity Screening in a Tertiary Care Centre. MVP J. Med. Sci. 2019; 6(2):202-209.