Original Article

Vision on wheels: Technician-assisted retinopathy of prematurity screening in rural Tamil Nadu and Andhra Pradesh: 2018–2021 Project Report

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Aim: To analyze the incidence of sight-threatening retinopathy of prematurity (ROP) in premature infants in rural Tamil Nadu and Andhra Pradesh from 2018 to 2021, and to analyze its association with birthweight (BW), gestational age (GA), and postconceptional age (PCA). **Methods:** Project Vision on Wheels is a free ROP screening and treatment program initiated by a tertiary eye care center in South India in June 2018 to screen preterm infants in rural areas in 11 centers in Tamil Nadu and Andhra Pradesh by trained technicians. Infants with sight-threatening ROP were immediately shifted for vision-preserving laser. **Results:** Of the 18,117 infants screened from 2018 to 2021, 1046 infants underwent laser, with the majority being bigger and more mature when compared to Western data. There was a yearly increase in the number of infants with sight-threatening ROP in the lower BW, GA, and PCA categories. The timely detection of the condition by committed screening led to salvage of vision by timely laser in 100% of the treated babies in all the years. The incidence of sight-threatening ROP had a yearly decrease in higher BW, GA, and PCA categories. These trends were statistically significant ($P = 0.001$ for ROP and BW, $P = 0.037$ for ROP and GA, and $P = 0.001$ for ROP and PCA). **Conclusion:** The statistically significant trend of decreasing sight-threatening ROP in babies with higher BW, GA, and PCA and increasing treatable ROP in younger and smaller babies (with lower BWs, GAs, and PCAs) in rural India, over time, is a hitherto unreported finding. This is the first such study in rural Tamil Nadu and Andhra Pradesh combined, with the largest data to date (as per MEDLINE search) to document this healthier trend.

Key words: 3nethra neo fundus camera, gestational age, laser, postconceptional age, retinopathy of prematurity, ROP, vision on wheels

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Retinopathy of prematurity (ROP) is a blinding disorder affecting preterm babies.[1,2] India accounts for the maximum number of preterm births in the world and hence a major contributor to childhood blindness due to this condition globally.[3-5] ROP is an underdiagnosed problem in rural India due to several logistic issues such as lack of trained specialists for diagnosis and treatment and lack of awareness among pediatricians and the public.[6,7] The exact incidence of ROP in rural India remains largely unknown.

Methods

Project Vision on Wheels was started in 2018 by a tertiary eye hospital in South India to identify infants in rural Tamil Nadu and Andhra Pradesh with ROP by using the 3nethra Neo fundus camera. The efficacy and safety of the fundus camera have been previously well established.[8]

A total of 11 centers that had no ongoing ROP screening program in both states were identified. These centers were visited by the Project Vision on Wheels team comprising technicians and nurses. The technicians were adequately trained and certified in the use of the fundus camera and in the diagnosis of the retinal conditions and stages of ROP. The training was done by the pediatric retina specialist of the hospital (the chief author of the paper) over 2 months by means of lectures on retina and ROP and hands-on experience by taking retinal photographs of the infants coming for ROP screening at the base hospital and later field visits with senior technicians and then after 2 months, individually. All technicians were optometrists who had basic knowledge of fundus photography of adults. All the data of the screened infants was entered into the laptop of the retinal camera on the day of the screening itself and entered into an Excel sheet the next day by the technician in the base hospital.

Fig. 1 shows the technician screening the eyes of a preterm baby with 3nethra Neo camera at Tirupattur (~224 km from Chennai). When in doubt, the technicians would share the images with the head of the pediatric retina department of the base hospital (the chief author of this paper). The infants identified to have sight-threatening ROP were shifted immediately to the base hospital for vision preserving laser.

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Early Treatment of Retinopathy of Prematurity (ETROP) guidelines were used for laser.[9] Green (532 nm) and yellow laser (577 nm) were used for the treatment, which was done in a single sitting, due to the difficulty in bringing the babies for repeat treatments. The screening and laser were done totally free of cost under the aegis of the public charitable trust of the hospital. Anti-vascular endothelial growth factor injections were not used in the treatment due to the possible logistic issues of following up these babies long term.

Figure 1: Shows the technician screening the eyes of a preterm baby with 3nethra Neo camera at Tirupattur (~224 km from Chennai)

Results

The total number of babies screened from June 2018 to December 2021 was 18,117. Of these, 1051 babies were identified to have treatable ROP, and 1046 babies with sight-threatening ROP underwent laser, with the majority being bigger and more mature when compared to Western data.

Amongst the lasered babies, 516 were male and 530 were female. In 2018, 177 babies were found to have sight-threatening ROP, of which 172 underwent treatment. In 2019, 2020, and 2021, 279, 244, and 351 babies were found to have treatable ROP, respectively, and all babies underwent laser [Table 1]. After the first year, there was a 100% compliance to the treatment and a 50% reduction in the number of babies with sight-threatening ROP (illustrated by the graph in Fig. 2a).

The majority of lasered babies were in the 1000–1500 birthweight (BW), 31–35 gestational age (GA), and 36–40 postconceptional age (PCA) categories in all the years [Tables 2–4, Fig. 2b–d]. There was a yearly increase in the number of babies with treatable ROP needing laser in the 750–1000 gm category (8%, 11%, 15%, and 11% in 2018, 2019, 2020, and 2021, respectively) and a decrease in the >2000 BW category (6%, 7%, 1%, and 1% in 2018, 2019, 2020, and 2021, respectively) in the number of babies with treatable ROP needing laser. In 2019 particularly, 11% of babies with treatable ROP were in the > 35 GA category,

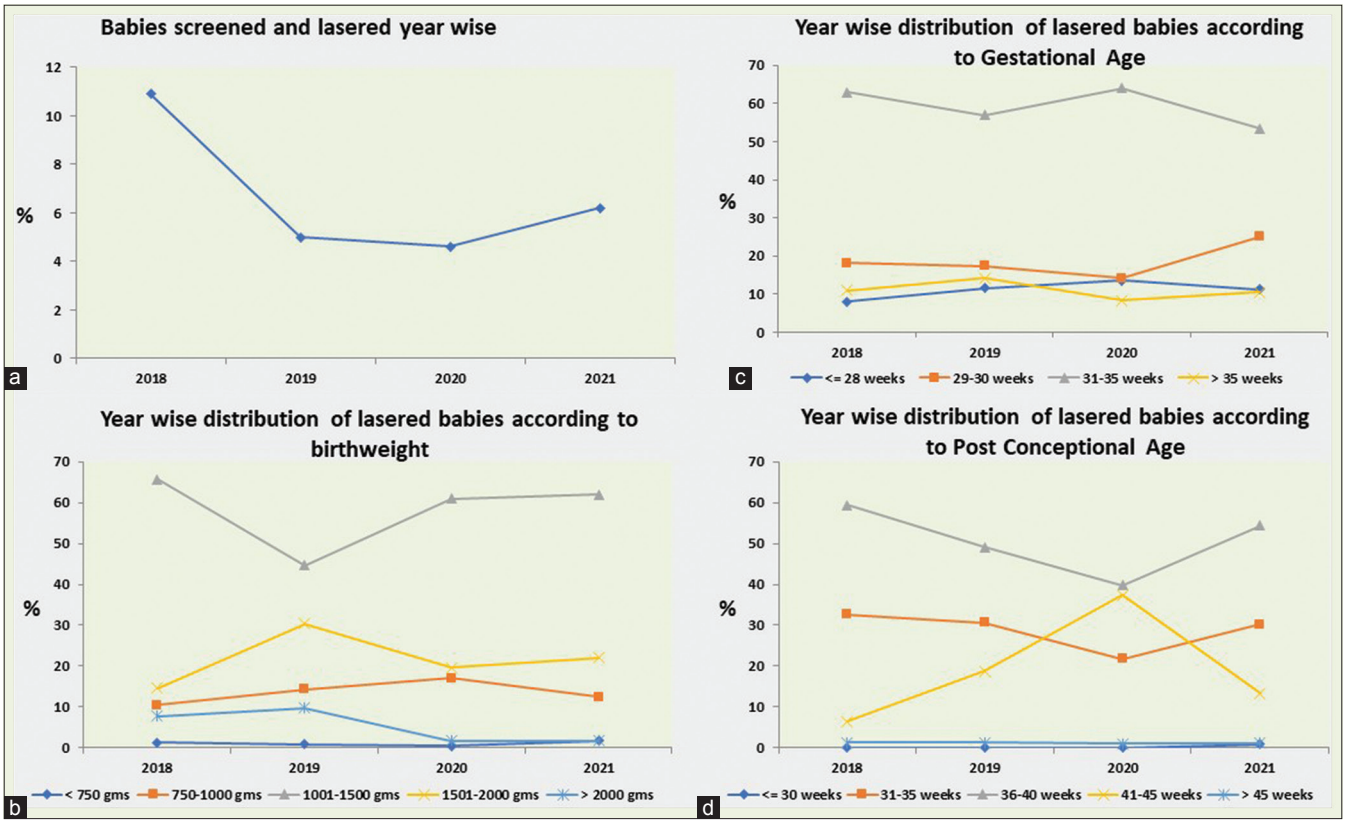

Figure 2: (a) Graph showing the overall year-wise trend of babies screened and lasered over time. (b) Graph depicting the year-wise distribution of lasered babies with sight-threatening ROP according to birthweight. (c) Graph depicting the year-wise distribution of lasered babies with sight-threatening ROP according to gestational age. (d) Graph depicting the year-wise distribution of lasered babies with sight-threatening ROP according to postconceptional age

Table 1: Total number of babies screened and lasered year-wise

Total No. of Babies Screened	2018 1582	2019 5616	2020 5277	2021 5642
Advised laser	177 (11%)	279 (5%)	244 (5%)	351 (6%)
Underwent Laser	172 (10.8%)	279 (5%)	244 (5%)	351 (6%)

Table 2: Year-wise distribution of lasered babies according to birthweight

Birthweight	2018 (*n*=172)	2019 (*n*=279)	2020 (*n*=244)	2021 (*n*=351)	Chi-Square	*P*
<750 g	2 (1%)	2 (0.7%)	1 (0.4%)	6 (2%)	49.52	0.001**
750–1000 g	15 (9%)	31 (11%)	37 (15%)	41 (12%)		
1001–1500 g	94 (55%)	97 (35%)	133 (55%)	203 (58%)		
1501–2000 g	21 (12%)	66 (24%)	43 (18%)	72 (21%)		
>2000 g	11 (6%)	21 (8%)	4 (2%)	6 (2%)		
NA	29 (17%)	62 (22%)	26 (11%)	23 (7%)		

NA: Data not available. **Statistically significant (99% confidence level) association between BW and ROP over time

Table 3: Year-wise distribution of lasered babies according to GA

GA	2018 (*n*=172)	2019 (*n*=279)	2020 (*n*=244)	2021 (*n*=351)	Chi-Square	*P*
≤28 weeks	11 (6%)	25 (9%)	28 (11%)	37 (11%)	17.87	0.037*
29–30 weeks	25 (15%)	38 (14%)	29 (12%)	82 (23%)		
31–35 weeks	87 (51%)	124 (44%)	132 (54%)	175 (50%)		
>35 weeks	15 (9%)	31 (11%)	17 (7%)	34 (10%)		
NA	34 (20%)	61 (22%)	38 (16%)	23 (7%)		

NA: Data not available. *Statistically significant (95% confidence level) association between GA and ROP over time

Table 4: Year-wise distribution of lasered babies according to PCA

PCA	2018 (*n*=172)	2019 (*n*=279)	2020 (*n*=244)	2021 (*n*=351)	Chi-Square	*P*
≤30 weeks	0 (0%)	0 (0%)	0 (0%)	3 (0.8%)	70.57	0.001**
31–35 weeks	45 (26%)	67 (24%)	45 (18%)	99 (28%)		
36–40 weeks	82 (48%)	107 (38%)	82 (34%)	178 (51%)		
41–45 weeks	9 (5%)	41 (15%)	77 (32%)	44 (13%)		
>45 weeks	2 (1%)	3 (1%)	2 (0.8%)	4 (1%)		
NA	34 (20%)	61 (22%)	38 (16%)	23 (7%)		

NA: Data not available. **Statistically significant (99% confidence level) association between PCA and ROP over time

while the percentage fell to 7% and 9% in 2020 and 2021, respectively. There was a yearly increase in the number of infants with sight-threatening ROP in the lower BW, GA, and PCA categories. The timely detection of the condition by committed screening led to salvage of vision by timely laser in 100% of the treated babies in all years. The incidence of sight-threatening ROP had a yearly decrease in higher BW, GA, and PCA categories. These trends were statistically significant ($P = 0.001$ for ROP and BW, $P = 0.037$ for ROP and GA, $P = 0.001$ for ROP and PCA).

Discussion

ROP is a blinding disorder affecting preterm babies, with India accounting for a major portion of the cases worldwide.[1,2] In India, ROP affects the babies of underprivileged parents, especially in rural areas; however, the incidence is largely unknown due to several issues such as lack of awareness and lack of screening due to lack of doctors, equipment, and poverty.[6,7] With the Government of India planning to set up a special newborn care unit (SNCU) in every district, the prospect of blindness due to lack of ROP screening looms large in rural India. Teleophthalmology and technician-assisted screening of neonates in underserved remote areas is the way to tackle this problem as has been reported previously in the world and India.[10-16]

Project Vision on Wheels, since its inception in 2018, has screened babies in 11 rural centers in the states of Tamil Nadu and Andhra Pradesh. This paper is report number 1 of the project and presents the incidence of sight-threatening ROP in premature infants in rural Tamil Nadu and Andhra Pradesh from 2018 to 2021 (largest data to date as per MEDLINE search). The other data of this period and that of the subsequent years will be presented in the next reports.

The most important finding of this paper is the hitherto unknown incidence of sight-threatening ROP in rural

Tamil Nadu and Andhra Pradesh, which fell from 11% in 2018 to 6% in 2021. Such findings of a fall in the incidence of ROP over time have been reported previously.[6,7,10] The fall could be attributed to the committed screening and treatment that were carried out uninterrupted against great odds even during the COVID waves. We postulate that the reporting of significant numbers of sight-threatening ROP by Project Vision on Wheels could have led to an improvement in the neonatal care practices by the neonatologists in the SNCUs, consequently leading to a decrease in the incidence of sight-threatening ROP over the years. There was in fact constant feedback to the neonatologists about the ROP occurring in higher BW and GA infants by the pediatric retina specialist of the base hospital (the chief author of the paper). We do not, however, have any documentation of the change in neonatal practices adopted; this is a limitation of our study.

The majority of lasered babies were in the 1000–1500 BW, 31–35 GA, and 36–40 PCA categories in all the years, which is commensurate with the Indian experience of ROP occurring in heavier and more mature infants.[2,4]

Another important finding in the study was the trend of decreasing treatable ROP in heavier and more mature babies (higher BWs, GAs, and PCAs) and increasing treatable ROP in smaller and younger babies (lower BWs, Gas, and PCAs) over time, which was statistically significant. This again could be attributed to the success of a committed screening strategy such as that of Project Vision on Wheels in reinforcing good neonatal care in rural areas. To the best of our knowledge, this is the first such study of ROP in rural India to demonstrate a statistically significant change in the trend of sight-threatening ROP over time with respect to BW, GA, and PCA.

As demonstrated by this study, a combination of a committed technician-assisted screening strategy with a handheld portable retinal camera and improved neonatal practices is crucial to address the huge burden of ROP-related blindness in rural India.

Conclusion

The statistically significant trend of decreasing sight-threatening ROP in babies with higher BW, GA, and PCA and increasing treatable ROP in younger and smaller babies (with lower BWs, GAs, and PCAs) in rural India over time is a hitherto unreported finding. This could be attributed to the committed screening strategy of the project Vision on Wheels. This paper presents the largest data to date (according to MEDLINE search) of sight-threatening ROP detected by 3nethra Neo in the rural areas in the twin states of Tamil Nadu and Andhra Pradesh.

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Conflicts of interest: There are no conflicts of interest.

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