

Increasing the Screening Rate of Retinopathy of Prematurity in at-risk Newborns- An Improvement Project in Special Newborn Care Unit of a Tertiary Care Maternity Hospital in Telangana

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ABSTRACT

Introduction: Retinopathy of Prematurity (ROP) is a vasoproliferative disorder of the retinal vessels in premature neonates and is one of the leading causes of preventable blindness. The incidence of ROP across India ranges from 38-47%. This wide range is due to a lack of awareness among parents and a lack of high-quality care in the Special New-born Care Unit (SNCU). Paediatricians, neonatologists, and ophthalmologists play a vital role in improving the screening rate.

Aim: To improve the screening rate of ROP at four weeks of age in at-risk new-borns by sensitising paediatricians and educating neonatal nurses and parents regarding ROP from the current 38.3-90% within three months.

Materials and Methods: The Plan Do Study Act (PDSA) quality improvement method was used for this project. It is a quality improvement (QI) study done in the SNCU of a tertiary care maternity hospital in Hyderabad, Telangana, India. The study was

done over a period of 13 months from January 2020 to February 2021. Baseline assessment was done by reviewing records and phone calls to know the baseline ROP screening rate. To improve the screening rate, the authors conducted periodic training of nurses, and awareness was increased among parents through audio-visual counselling, ROP posters, and timely reminders.

Results: In 368 preterm babies, the ROP screening rate increased from 38.3-89.95% in phase 3. The knowledge in nurses' and parent's also increased significantly post-training ($p < 0.05$). The incidence of ROP was found to be 6.04% (20) in the present study.

Conclusion: The Point of Care Quality Improvement (POCQI) method helped in improving the ROP screening rate tremendously without many resources. It also significantly improved the knowledge of nurses and awareness among parents. The nurses had a sense of empowerment and satisfaction and could effectively communicate with parents.

Keywords: Counselling, Neonates, Nurses, Quality improvement, Vasoproliferative disorder

INTRODUCTION

Retinopathy of Prematurity (ROP) is due to abnormal neurovascular development of the retinal vessels in premature infants. These abnormal vessels are fragile, can bleed and cause scarring of the retina leading to tractional retinal detachment. This is the main cause of blindness in ROP. It is one of the leading cause of preventable blindness in South East and South Asia [1-4]. The incidence of ROP across India ranges from 38-47% [5-8]. In 2010, India accounted for 10% of the worldwide estimates of blindness and visual impairment due to ROP [6]. Despite the rapid increase in the neonatal intensive care units and Special New Born Care Units (SNCUs) across India, the incidence of ROP has not changed much. [9] This problem is due to the lack of awareness among parents regarding ROP, its complications, importance of timely screening, [10] and the lack of high-quality care in SNCUs [11-13]. Early identification of ROP changes in the eyes and timely treatment can save the vision and improve overall development. Paediatricians, neonatologists, and neonatal nurses play a vital role in educating and counselling parents. The multidimensional role of nurses in improving the ROP screening rate has been demonstrated in various studies [14-16].

The National Neonatology Forum recommends screening of all babies with birth weight < 2000 g or gestational age < 34 weeks

or infants 34-36 weeks of gestational age with risk factors at four weeks of birth and for smaller babies with gestation less than 28 weeks or birth weight less than 1200 g, at 2-3 weeks of age [17-18]. The hospital SNCU provides care for 2850 babies annually, including 650 preterm babies at risk for ROP. Unfortunately, a 3-month retrospective data review revealed that only 38.3% of babies had a timely screening for ROP. To improve the screening rates, the (POCQI) Point of Care Quality Improvement model was followed for capacity building in healthcare by sensitising paediatricians, educating neonatal nurses, and counselling parents [19-21].

The quality improvement project described in this article was conducted to improve the screening rate of ROP at four weeks of age in at-risk new-borns by sensitising paediatricians and educating neonatal nurses and parents regarding ROP from the current 38.3% to 90% within three months.

MATERIALS AND METHODS

It is a quality improvement (QI) study done in the SNCU of a tertiary care maternity hospital in Hyderabad, Telangana, India. The study was done over a period of 13 months from January 2020 to February 2021. The study was reviewed and approved by Institutional Ethics Committee (IEC approval number. Ref.No.IEC/OMC/2022/M.

No.(1)/Acad-9 dated on 25th Feb 2022), Osmania Medical College, Koti, Hyderabad.

Inclusion criteria:

- All babies with birth weight less than or equal to 2000 g or gestational age less than 34 weeks.
- Infants 34-36 weeks of gestational age with risk factors (cardiorespiratory support, prolonged oxygen requirement, respiratory distress syndrome, chronic lung disease, blood transfusion, sepsis, exchange transfusion, intraventricular hemorrhage, sepsis).

Exclusion criteria: All babies with birth weight >2000 g and Gestational age >34 weeks with no risk factors were excluded from the study.

All babies who fit the inclusion criteria and discharged from the SNCU from January 2020 to February 2021 were included in the study. The SNCU of Petlaburz, Hyderabad, is a tertiary care maternity hospital delivering level II care to 650 preterms annually, mainly from the middle-low socio-economic status group. This unit contains 20 beds and two CPAP machines. The clinical providers include 4 paediatricians and 14 nurses. All the paediatricians were well aware of ROP, the importance of timely screening, and its complications. After obtaining approval from the ethical review committee, the quality improvement study was done in inborn, at-risk babies from January 2020 to February 2021.

Baseline Data

Baseline assessment regarding the existing percentage of ROP screening rate was done by reviewing records and phone calls two months before the intervention and recorded in datasheets.

Intervention

A Quality Improvement (QI) team was formed initially consisting of three doctors (lead investigator, co-investigator, and SNCU officer), two neonatal nurses, one postgraduate student, and one parent of a neonate. The study was conducted in 3 phases- phase 1 (3 months), phase 2 (3 months), and phase 3 (7 months).

In phase 1, various reasons for delayed/no screening for ROP were elicited through a fishbone diagram and the various steps of care were derived through Process mapping. The knowledge of SNCU nurses regarding ROP was assessed using a self-designed questionnaire. Similarly, awareness among parents of at-risk new-borns was assessed using a self-designed questionnaire. Uhumwangho O and Israel-Aina Y, [22] administered a questionnaire to paediatricians and residents in paediatrics attending a continuous professional development (CPD) course to determine the level of awareness of the screening protocols for retinopathy of prematurity (ROP). Uhumwangho O and Israel-Aina Y, included a total of 48 respondents [7 (14.6%) were qualified paediatricians and 41 (85.4%) were residents in training]. To arrive at the determination of required number of participants for this current study authors assumed number of respondents as 48 with a confidence interval of 90% and margin of error as 5%, The arrived sample size for this survey was 40. Hence, the questionnaire was administered to 20 nurses and 20 parents. It was devised based on the standard guidelines of National Health Mission. The self-designed questionnaire for nurses had eight closed questions with seven multiple-choice options and one dichotomous question covering eligibility criteria for screening, risk factors for ROP, age of first screening, complications, etc. Each

correct answer was given a score of +1, while the wrong answer got 0 (maximum score +8 and minimum 0). The questionnaire for parents included four dichotomous (Yes/No) questions.

Based on the above result, in phase 2, it was decided to educate and train nurses and counsel parents regarding ROP and the importance of timely screening to prevent visual impairment and blindness. The QI team prepared the training material, and all the SNCU nurses were educated and trained shift-wise at their place of duty. The key components of training were - risk factors associated with ROP [23] and measures to reduce them, like appropriate oxygen therapy, encouraging breastfeeding and support for nutrition, hand hygiene and asepsis to reduce infections, Kangaroo Mother Care (KMC), leadership, and mentoring among nurses and efficient counselling of parents.

For educating and counselling parents, posters were displaced at appropriate places in the KMC and the follow-up rooms. Initially, counselling was done by nurses but found that uptake was low after testing for one week; hence counselling was done twice by both nurses and doctors, reinforcing the risk of ROP, the timing of ROP screening, the specialist, and the place where it is done and the need for urgent treatment for an infant with threshold ROP. In addition, the audio-visual method of counselling was also tested and implemented.

A ROP register was maintained, and the names, addresses, and phone numbers of all the babies who required screening with their screening date were entered in the register. One of the QI team members was assigned to supervise the new system, follow-up on these babies, make reminder calls two days before the scheduled date, and monitor the screening rate fortnightly. The ROP screening was done once a week at a tertiary care paediatric hospital attached to this SNCU. The results of the ROP screening were entered at the follow-up visit to the SNCU.

In phase 3, hardwiring was done by documenting the flow of new processes, having written standard operating procedures, mentoring, and periodic training of neonatal nurses and the new staff. Also, the QI team met once a month to collect the feedback and make any further system changes, if required.

Study of Intervention

The study of the intervention was done through small Plan-Do-Study-Act (PDSA) cycles to test each change that was expected to increase the screening rate. The change ideas were decided based on the driver diagram. The parameters compared were-

- Improvement in the knowledge of nurses before and after training
- Improvement in the awareness of parents before and after counselling
- Improvement in the screening rate of at risk new-borns before and after the intervention phase

Measures

Process measures: Knowledge in nurses: Percentage of nurses correctly answering the post-training self-designed questionnaire out of the total nurses trained.

$$\frac{\text{Number of nurses correctly answering the post-training self designed questionnaire}}{\text{Total number of nurses trained}} \times 100$$

Awareness among parents: Percentage of parents correctly answering the post counselling self-designed questionnaire out of the total parents counselled.

$$\frac{\text{Number of parents correctly answering the post counselling self designed questionnaire}}{\text{Total number of parents counselled}} \times 100$$

Outcome measure: Percentage increase in ROP screening rate out of the total eligible babies for ROP.

$$\frac{\text{Number of newborns screened for ROP at 1 month of age in a month}}{\text{Total number of eligible newborns for ROP in a month}} \times 100$$

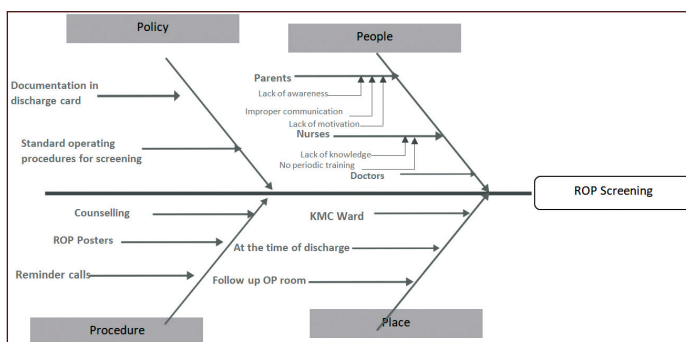
STATISTICAL ANALYSIS

Analysis of the problem was done through qualitative approaches like a fishbone diagram for root cause analysis as it reveals causes at various levels and Process mapping to know the existing process of care so that intervention can be planned for accordingly. Analysis of the outcome was done through a time series chart to allow for temporal insights between time series data and changes in the system. The qualitative values are expressed as frequency and percentages. The differences were analysed with a Chi-square, Fischer exact test. The responses obtained were analysed using SPSS version 22.0 and p-values <0.05 were considered statistically significant.

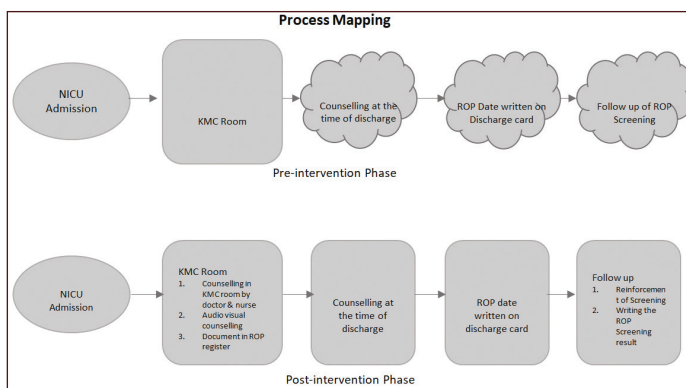
RESULTS

During this study, 368 preterm babies who met the criteria for ROP screening were encountered, and the percentage of babies screened for ROP within one month of birth was found to increase from 38.75% (62 out of 160) to 89.95% (331 out of 368) at the end of the intervention, meeting our goal of 90%. Out of the 368 preterm babies, 48.91% (180) were males, and 51.08% (188) were females. In addition, 36.96% (136) of babies were less than or equal to 1.5 kg, and 63.04% (232) were above 1.5 kg.

In phase 1, it was found that the counselling was not done properly, and the ROP screening protocol was not strictly followed. By Fish bone analysis [Table/Fig-1], the authors came to know the various causes of decreased ROP screening rate like lack of awareness among parents, improper counselling and lack of motivation of parents. Nurses didn't have adequate knowledge and there were no periodic training sessions conducted for them. Doctors also didn't supervise and monitor the nurses. There were no standard operating procedures for screening and proper procedure was not followed. The process of care in the hospital was known by Process mapping [Table/Fig-2]. In preintervention phase, it is not certain if counselling regarding ROP screening was done at the time of discharge and ROP date was written on the discharge card or not and whether these babies were being followed for screening. But in the postintervention phase, it is made sure that counselling regarding ROP screening was done in the KMC room and also emphasised and written on the discharge card at the time of discharge. The nurses had poor knowledge regarding ROP (median score of 3.65 out of 8) [Table/Fig-3]. The awareness of parents regarding ROP was also poor (median score of 1.25 out of 4) [Table/Fig-4]. 70% of parents did not know that preterm babies will have eye problems, 60% did not know that eye examination is needed. Only 25% have the idea of where this eye examination is done and 60% of parents can't even understand that their baby was born preterm.



[Table/Fig-1]: Fishbone analysis for improving ROP screening rate.



[Table/Fig-2]: Process mapping.

Question	Phase 1 N (%)	Phase 3 N (%)	p-value
Gestational age criteria of ROP screening	6 (30%)	20 (100%)	<0.001
Birth weight criteria for ROP screening	8 (40%)	20 (100%)	<0.001
Risk factors for ROP	5 (25%)	18 (90%)	<0.001
Age at which ROP screening should be done	8 (40%)	20 (100%)	0.001
Full form of ROP	15 (75%)	20 (100%)	0.04
Complications of ROP	4 (20%)	15 (75%)	0.001
Age at which 2 nd examination should be done	3 (15%)	19 (95%)	<0.001
Legal issues of ROP	11 (55%)	20 (100%)	0.001

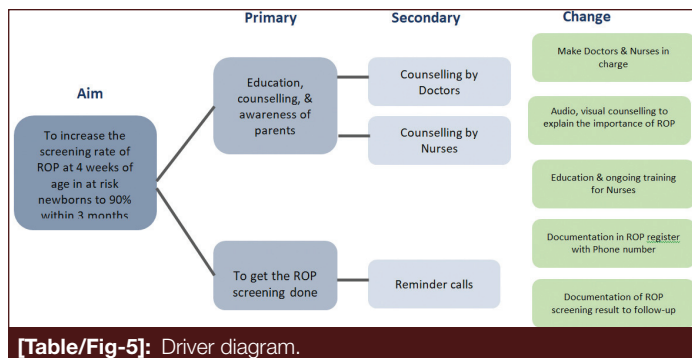
[Table/Fig-3]: Nurses answering correctly (N=20). Chi-square, Fischer exact test are used

Question	Phase 1 N (%)	Phase 3 N (%)	p-value
Knowledge of eye problems in preterm babies	6 (30%)	20 (100%)	<0.001
Is eye examination needed	8 (40%)	20 (100%)	<0.001
Place of eye examination	5 (25%)	18 (90%)	<0.001
Is their baby born preterm	8 (40%)	20 (100%)	<0.001

[Table/Fig-4]: Parents answering correctly (N=20). Chi-square, Fischer exact test are used

The baseline ROP screening rate was also only 38.3%. Driver diagram [Table/Fig-5] helped to know the various changes which could be made to help in improving the screening rate. Through driver diagram the authors could find the key or primary drivers which they needed to influence in order to achieve the aim i.e; education, counselling and awareness among parents and to get ROP screening done. The secondary drivers helped them to identify the specific interventions that are necessary to achieve the primary drivers and finally change ideas were designed to

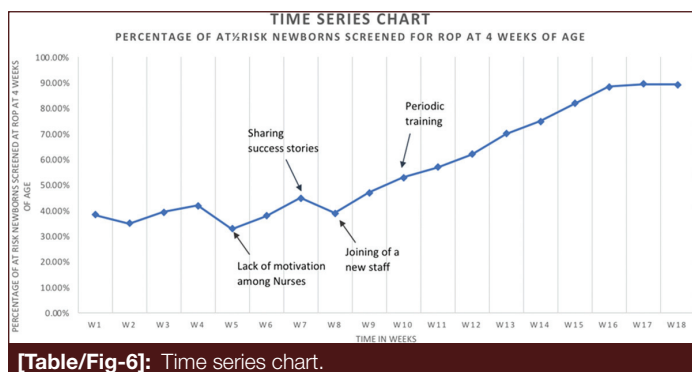
address the secondary drivers i.e; the changes the authors can make for improvement.



[Table/Fig-5]: Driver diagram.

Specific interventions were made to increase the knowledge and awareness regarding ROP. Key interventions that were made in phase 2 included: 1. Training of neonatal nurses; 2. Effective counselling of parents both by nurses and doctors; 3. Displaying ROP screening guidelines in the KMC room and high-risk follow-up room; 4. Writing the date of screening in the discharge card; 5. Maintaining ROP register; 6. Fixing the place and date of screening, and 7. Give reminder calls two days prior to the scheduled date.

After the intervention, a new process of counselling was followed [Table/Fig-2], Number of nurses and parents correctly answering the questionnaire after training showed a significant improvement [Table/Fig-3]. The knowledge of nurses regarding ROP has increased with a median score of 8 on an 8- point questionnaire and a p-value of $p < 0.001$ [Table/Fig-3], and the awareness among parents has also increased with a score of 3.5 on a 4 point questionnaire and a p-value of $p < 0.001$ [Table/Fig-4]. Statistically significant difference was observed between pre and postintervention questionnaires administered to parents and nurses. During the period of intervention ROP screening rate increased to 62%, as shown by a time series chart [Table/Fig-6]. The dips in the screening rate were due to a lack of motivation among nurses, the joining of new staff, and parents from far-off places. Many of these reasons were successfully handled by strong leadership, periodic training of nurses, sharing success stories, and reinforcing the importance of ROP.



[Table/Fig-6]: Time series chart.

In phase 3, periodic training and mentoring of neonatal nurses was done, and data on the ROP screening rate was collected. Also, the reasons for any decline in performance were detected and corrected. ROP screening rate in phase 3 increased to 89.95% (331) compared to 38.3% at the start of the intervention. The incidence of ROP was found to be 6.04% (20) in the present study. Among the remaining 37 (10.05%) babies, 22 babies were traced with phone calls, and the various reasons for missed screening were enquired. The most common reasons were transportation limitations, preterm baby care issues, missed workdays by caregivers, and the average

low-income population. Fifteen babies could not be traced by either phone calls or at follow-up visits.

DISCUSSION

Screening for ROP was identified to be the foremost step in preserving vision in preterm infants. This was supported by the CRYO-ROP and ETROP studies which showed that preterm infants are at increased risk of ROP and timely treatment with peripheral retinal ablation can help to preserve the vision in these babies [24,25]. Therefore it is necessary to identify the various steps to improve the screening rate and take measures appropriately. The role of nurses in this process cannot be underestimated. Nurses are the primary medical caregivers and the pillars of the special care new-born units (SCNU). They play a critical role in the prevention and management of ROP. Improving the knowledge and training of nurses helps a long way in achieving an ROP-free survival of the new-born. Murki S and Kadam S, [16] showed that the knowledge of nurses and their clinical skills are essential for providing best practices in quality care and thereby help in preventing ROP in preterm babies. Also the need to increase competence based training among nurses was shown by Campbell-Yeo M et al., [26]. Hence, the focus was to improve knowledge among nurses by periodic training.

The role of parental education in increasing the screening rate is also equally important which is shown by Padhi TR et al., [27] who studied the various barriers to timely screening and showed that parental ignorance and negligence are important factors contributing to ROP development. Vinekar A et al., [14] and Flanagan J et al., [28] also emphasised the importance of increasing awareness and maintaining good communication with parents to increase the screening rate. The authors therefore included parental education as one of the measures to improve ROP screening rate.

The present study results are similar to the results of a 2018 QI study in Delhi done by Mehta P et al., in which the ROP screening rate had improved from 10.7% in the preintervention phase to 87.3% in the post-intervention phase [29]. The main interventions in both the studies were training of nurses and counselling of parents. Barry GP et al., [30] has made a few policy changes like parent education forms, streamlined scheduling, creation of a log for all patients and found an increase in the ROP screening rate from 42-81%. Few policy changes like maintaining an ROP register, writing the ROP date in the discharge card and following standard operating procedures were also made in the present study. In the authors knowledge, this is the first QI study on ROP in SCNU of South India. This could be achieved by simplifying the training material and involving parents in the care of their babies.

It was learned that the parents were happy to be involved in their babies' care and to know that a simple screening procedure can prevent such a blinding disease. The nursing staff were also able to communicate with the parents effectively and had a sense of empowerment and satisfaction.

Limitation(s)

The study's limitations include involving only inborn NICU graduates, invalidated questionnaires, ROP screening done at an outside hospital, and a short duration of the post-intervention

phase. The authors could not achieve a 100% screening rate due to distance, preterm baby care issues, low socio-economic status, etc.

CONCLUSION(S)

The Point of Care Quality improvement (POCQI) method helped to improve the ROP screening rate tremendously by using simple measures without any additional resources in a short period. It also significantly improved the knowledge of nurses and awareness among parents. The nurses had a sense of empowerment and satisfaction and could effectively communicate with parents. Only by following a simple systematic approach through QI methods, we can bring great changes in the lives of these preterm babies in a resource-limited setting.

Timely referral and meticulous examination by an experienced ophthalmologist should be done. Media should be used to create awareness among the people and posters in local languages should be displayed in public places, in cinema theatres, etc. QI studies can be done in every healthcare facility to improve their screening rates.

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