ORIGINAL ARTICLE

# Comparison of Tele Screening for Retinopathy of Prematurity Screening and Impact of Neonatal Team Support in Government and Private Centers in Rural Bijapur District of Southern India

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## ABSTRACT

**Purpose:** To compare the incidence of retinopathy of prematurity (ROP) with neonatal support provided during tele-ROP screening between government and private hospitals in rural Bijapur district of Karnataka.

**Methods:** One government and four private hospitals under the ROP screening program between July 2011 and July 2012 were included. All infants born <2000 g at birth were imaged on a weekly basis. Centers were classified as "supportive" or "non-supportive" based on the support extended to the visiting team. Yield of enrollment and disease burden were compared between the centers.

**Results:** Of the 145 infants analyzed, the mean incidence of any stage and treated ROP in the government center was 27.3% and 0% versus 36.6% and 9.7% in the private units, respectively. The proportion of infants enrolled in the government hospital was 40.7% versus 88.9% (mean) in the private hospitals. In the two "supportive" hospitals, the enrollment was 100% and 159.3% respectively, whereas it was 38.7% and 58.7% respectively in "non-supportive" units.

**Conclusions:** The incidence of ROP in rural Bijapur is comparable to urban centers in India. Good pediatric and nursing support enhances infant enrollment into an ROP screening program. Private hospitals may have higher treatable ROP because of the sicker infants they admit. The report emphasizes the need to strengthen ROP screening programs in rural India.

**KEY WORDS:** ROP, prematurity, Tele ROP screening

## INTRODUCTION

With improved survival rate of very premature babies, retinopathy of prematurity (ROP) is emerging as a significant cause of severe visual disability in children in developing countries like India.[1] The disease, if not treated on time, causes irreversible blindness. India and other middle income countries are believed to be suffering from the 'third' epidemic.[2-4] Owing to an asymptomatic nature of the disease in its early course, a good screening program is vital for early detection and treatment of this disease. Although the overall prevalence in India is unknown, the incidence reported lies between 22% and 52% in urban centers.[5-7] Due to lack of awareness, many pediatricians refer babies for ROP screening to the ophthalmologist only when a white reflex is detected either by the parents or by themselves by which time, the baby is irreversibly blind.[8,9] Until recently, there were no ROP reports from rural India. Recently, Hungi *et al*. reported ROP from rural Kolar district of Karnataka which demonstrated that the incidence was comparable to other urban centers in India.[10] Since 2008, a tele-ROP screening program in rural Karnataka, namely the Karnataka Internet Assisted Diagnosis of ROP (KIDROP.org) has been

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providing ROP screening routinely, by employing non-physician, trained technicians who capture and report wide field retinal images of "at risk" babies in the rural centers itself.[10-18]

This manuscript reports the incidence and disease characteristics from Bijapur district, in North Karnataka, Southern India where KIDROP has been screening since 2011. Government and private hospitals that were included in this district were compared for ROP demographics. We also highlight the role of support provided by the pediatrician in this program and its impact on ROP screening.

## METHODS

This study reports the first year data of ROP screening enrollment from Bijapur district headquarters. Bijapur is one of six districts that is included in the North Karnataka zone of the KIDROP tele-ROP program. The method of tele-screening has been previously reported.[11,18,19] Briefly, level three technicians who are accredited to capture, save, store, forward, analyze, and report images using an indigenously created three-way decision algorithm are employed to visit centers that have "at risk" babies. A single level three technician visits each study center every Thursday, since inception of the program in July 2011 to date, along with a project manager who would schedule, follow-up, and record all data generated during the screening program. One government and four private hospitals were included for ROP screening. Infants <2000 g ("at-risk") at birth were recruited. Retcam images (Retcam Shuttle, Clarity MSI, USA) were obtained at each visit based on the published protocol.[11,18,19] The KIDROP team performed pre- and post-counseling to mothers about the disease and the need and timing of follow-up.[10,11,18] Images were read by the technicians on site based on the KIDROP triage algorithm, and uploaded for the ROP specialist in Bangalore to review.[11] All screening and treatments performed with laser photoablation were done at no cost to the patient or to the recruited hospital even when this was a private organization. The equipment, maintenance and the recurrent costs of the program were supported by a public–private partnership fund, approved by the National Rural Health Mission, Government of Karnataka.

For the purpose of this study, the pediatricians (or neonatologists, where applicable) support offered to the ROP team was graded. A NICU was classified as "supportive" or "non-supportive" in the ROP screening program activities of the team.

The attributes of a "supportive" NICU were: (1) voluntarily initiating and allowing ROP screening in their NICU, (2) supporting the team with logistics during the screening routine, (3) creating awareness among the nursing staff about ROP screening, (4) timely referral of all "at risk" infants according to the prescribed guidelines, (5) timely and appropriate dilatation of the babies prior to, or at least along with, the team at each screening visit, (6) counseling of parents during and/or after the visit of the team about ROP and emphasizing the need for follow-up, (7) ROP follow-up date and time mentioned on the discharge card, (8) maintaining and updating the ROP register in the NICU, (9) participating in awareness and monitoring meetings which were conducted periodically, and (10) promoting awareness and emphasizing long-term follow-up with the ophthalmologist.

A NICU was considered "supportive" if it performed or complied with a minimum of 7 of the above 10 criteria. Those between 5 and 7 points were counseled for improvement. Those who persisted below 5 despite regular counseling and awareness generating activities were classified as "unsupportive." No NICU was denied ROP screening or treatment even if they were "unsupportive." Activities that were not performed by the unsupportive NICUs were undertaken and completed by the KIDROP team as far as possible. In supportive NICU's the ROP team served the role of an adjunct team member. Constant awareness building was attempted during each visit to improve the participation of the NICU.

Pre-counseling is an important strategy and involves providing an "ROP card" (on which all screening data is recorded and given to the mother). On this card, the next ROP screening date is written and explained to the mother. If this date happens to be after the baby's discharge from the NICU, the mother is counseled to return to the NICU for screening on that day.

The study has met the approval of the Institute Review Board and the Ethics Committee, and informed

consents were taken in all cases for all procedures performed. Statistical analysis was done using Chi-square test and Fisher's exact test.

## RESULTS

For the purpose of this manuscript, the names and the location of the five hospitals included in the study have been anonymized. The NICUs and admission details are summarized in Table 1 and demonstrate that the private hospitals have more admissions than the public institutions.

The total number of babies born <2000 g at birth in all the centers was 496. A total of 554 "at risk" infants were enrolled in the study, of which 210 (37.90%) were female and 344 (62.09%) were male babies. The distribution of enrollments in the five centers is summarized in Table 2.

The disease burden was assessed by computing the different stages of ROP. The distribution is summarized in Table 3.

Comparing the proportion of enrollments (i.e. at risk babies who were enrolled / total number of at risk babies), the government hospital showed lower enrollment (40.7%) compared to (88.9%) in the private hospitals combined ($P < 0.05$) (Figure 1). The mean incidence of treatable ROP in the four private hospitals was higher than the government hospital (Figure 1).

We observed 2 supportive and 2 non-supportive private centers. To anonymize their identity we have named them I, II, III and IV. Of these I and II were supportive and III and IV were non-supportive. We computed the enrollment in these centers and have summarized it in Figure 2. The two supportive centers showed 100% and 159.3% enrollment. The reason why one of these centers showed higher than 100% enrollment was because they proactively achieved the enrollment of babies from other centers who visited their unit during the visit of our team. The two non-supportive units achieved an enrollment of 38.7% and 58.7% respectively ($P < 0.05$).

The mean incidence of any stage ROP was higher in the private hospitals compared to government hospitals (36.6% vs. 27.3%) ($P < 0.05$). Treated ROP was higher in the private versus government hospitals (9.7% vs. 0%) ($P < 0.05$) (Fisher's exact test).

**Table 1: NICUs and admission details at study centers.**

| Hospitals | Level of NICU | Number of neonatal beds | Date of enrollment | Admissions (as in NICU hospital registers) |
|---|---|---|---|---|
| Government | 2 | 10 | 14/7/2011 | 336 |
| Private A | 2 | 14 | 14/7/2011 | 487 |
| Private B | 2 | 11 | 14/7/2011 | 286 |
| Private C | 2 | 15 | 13/10/2011 | 304 |
| Private D | 3 | 25 | 14/7/2011 | 1232 |

NICU: Neonatal intensive care unit

**Table 2: Enrollments at different centers.**

| Hospitals | Admissions<2 kg BW | Total no enrolled for ROP screening | Total number of females (%) | Total number of males (%) |
|---|---|---|---|---|
| Government | 17 | 18 | 11 (61.11) | 7 (38.89) |
| Private A | 103 | 130 | 36 (27.69) | 94 (72.31) |
| Private B | 50 | 50 | 25 (50) | 25 (50) |
| Private C | 139 | 166 | 79 (47.59) | 87 (52.41) |
| Private D | 187 | 190 | 59 (31.05) | 131 (68.95) |
| Total | 496 | 554 | | |

ROP: Retinopathy of prematurity

**Table 3: Distribution of ROP at different centers.**

| Hospitals | Babies with any stage ROP | Babies with stage 1 ROP (%) | Babies with stage 2 ROP (%) | Babies with stage 3 ROP (%) | Babies with APROP (%) | Babies treated (%) |
|---|---|---|---|---|---|---|
| Government | 4 | 1 (25) | 3 (75) | 0 (0) | 0 (0) | 0 (0) |
| Private A | 22 | 15 (68.18) | 6 (22.27) | 1 (4.54) | 0 (0) | 3 (13.63) |
| Private B | 14 | 5 (35.71) | 9 (64.28) | 0 (0) | 0 (0) | 1 (7.14) |
| Private C | 25 | 12 (48) | 13 (52) | 0 (0) | 0 (0) | 4 (16) |
| Private D | 80 | 33 (41.25) | 42 (52.5) | 1 (1.25) | 4 (5) | 3 (3.75) |

APROP: Aggressive posterior retinopathy of prematurity, ROP: Retinopathy of prematurity

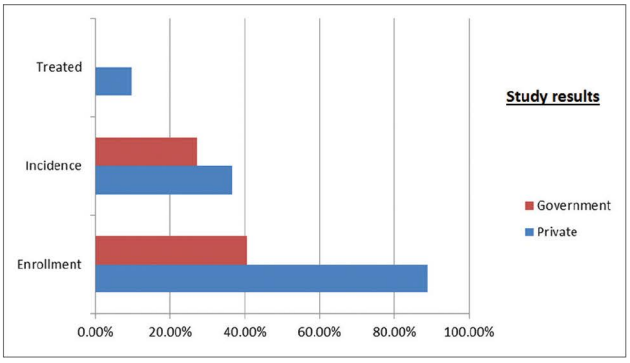


**Figure 1:** Data distribution and enrollment in different sectors.

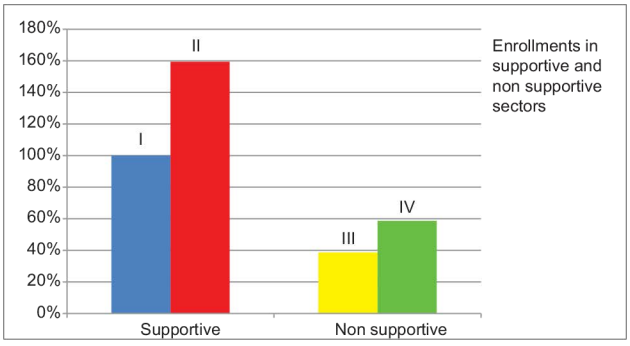


**Figure 2**: Enrollment in supportive and non supportive sectors.

## DISCUSSION

ROP is emerging as a major public health problem in India. KIDROP initiated in 2008, expanded from six pilot districts of Southern Karnataka to 18 districts in all. Bijapur is one of six districts that is included in the North Karnataka zone and was initiated in July 2011. Of the babies screened with birth weight <2000 g, 147 of 554 (26.5%) infants had retinopathy of prematurity.

The incidence of any stage ROP in our study was 36.6% in the private sector and 27.3% in a government hospital. This is more comparable to previous data from urban nurseries i.e. 37-54% than when the overall incidence of the entire cohort is compared.[7,19-26] Recently Hungi *et al*. from Kolar district have reported an ROP incidence of 41.6%. This was the first prospective rural study from India from a tertiary care medical college teaching hospital. Treated ROP was higher in the private versus government hospitals (9.7% vs. 0%) ($P < 0.05$) almost comparable to 8% in Hungi *et al*. Of the total recruitments (to projected "at-risk of"), the government hospital showed lower enrollment (40.7%) compared to a (88.9%) in the private hospitals ($P < 0.05$).This could be attributed to lack of awareness about the need for screening among the referring pediatricians and the nursing staff. Awareness about ROP is poor among the pediatricians in India.[20,21] ROP referral practices are better in the urban sectors compared to the rural sectors and more referrals are observed from private hospitals compared to rural government hospitals.[22]

Our study shows that in rural centers when there may be no ROP specialists, a team comprising of trained non-physicians can provide ROP screening using tele-medicine. A dedicated ROP team is very important for the success of an ROP screening program especially in rural, remote and outreach centers. To our best knowledge, the impact of the support of pediatricians and the nursing staff on the enrollment of infants in an ROP screening program has not been studied before. We explored the role of support from the NICUs in this manuscript and report ten attributes of a "supportive" NICU. We observe that the cooperation of the resident doctors and nursing staff is critical to the success of the ROP screening program.

In the private hospitals, the enrollment in the two "supportive" hospitals was 100% and 159.3% compared to 38.7% and 58.7% in the "non-supportive

centers." Furthermore, there was a poorer response from the government hospital. Strategies to improve enrollment are necessary in government hospitals, so that more "at-risk" babies are covered in the program.

ROP is a convergent disease. The neonatologist or pediatrician should help in timely referral for better recruitments. A designated "ROP doctor," one from the department of ophthalmology and another from pediatrics or neonatology in government hospitals who had been sensitized and trained in the program would enhance support from the NICU. A cooperative neonatal team will result in a higher yield of infants developing disease and requiring treatment. Good pediatric and nursing support enhances infant enrollment into an ROP screening program. Private hospitals may have higher treatable ROP because of the sicker infants they admit. The report emphasizes the need to strengthen ROP screening programs in rural India and create stronger linkages in government hospitals who have a large burden of infants who require ROP screening.

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