RETCAM: Clinical Applications in Retinopathy of Prematurity

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Retcam is a useful tool that has revolutionized the technique for screening of retinopathy of prematurity (ROP). Retcam is short for Retinal Camera, a wide field digital imaging equipment for examining the pediatric fundus. While indirect ophthalmoscopy needs expertise, the Retcam allows ROP screening to be performed by anyone with suitable training and get reproducible results quickly. In poorly cooperative children, the Retcam may be a good alternative to examination under anesthesia or sedation in selected cases.

While it is an excellent tool for peripheral screening in ROP, it has also been used extensively for examination in other diseases like retinoblastoma, and is also useful for anterior segment imaging and gonio-imaging in cases of glaucoma and iris lesions.

The Retcam

There are 2 types of models available in the market – Retcam 3 (Figure 1a) and Retcam Shuttle (Figure 1b). The Retcam 3 features an integrated body with monitor, inbuilt keyboard, fluorescein angiography module, and printer. The Retcam shuttle is more portable as the major components are integrated into a laptop, so it can be easily transported for use in the OT, NICU and screening in peripheral centres.

Retcam is an useful tool to snap digital images of both the anterior and posterior segment of the eye. All images are stored in a local database, which allows easy retrieval and access of images over time, as well as side-by-side comparison. A special attachment allows users to perform fluorescein angiography too.

Multiple lenses with different magnifications are available to be attached to the handheld camera. The most commonly used lens has a field of 130° and can easily visualize the retinal periphery in ROP eyes.

Current ROP screening guidelines

The International ROP screening guidelines suggest that all babies <30 weeks gestation age and <1500 g birth weight should be screened for ROP. However, bigger babies can also be screened if the neonatologist believes the baby is at high risk to develop ROP. The Indian ROP guidelines suggest we can screen babies <34 weeks gestation age and <1700 g birth weight or higher if the neonatologist believes the child is at high risk to develop ROP. This third criteria is important as it allows heavier, but high risk babies to enter the screening program while following the current guidelines.

It is recommended that all babies eligible for screening should undergo one ROP screening within the first 30 days.

Figure 1a: Retcam 3 Figure 1b: Retcam Shuttle
of life. In very low birth weight babies, it is suggested these babies may be screened as early as 2-3 weeks of life.

**Retcam Procedure**

Before start of the Retcam examination, it is essential that the pupils are dilated well. Pupils are dilated with 2.5% phenylepherine and 0.5% tropicamide eye drops, used 10 min apart, half an hour before the procedure. While pupillary dilation is very essential to get a good view of the fundus, sometimes it may be difficult in cases of plus disease where pupils do not dilate easily. Poorly dilating pupils may mask severe disease behind and the observer needs to be cautious in these cases.

Topical proparacaine eye drops are used for topical anesthesia. After a pediatric lid speculum is inserted, a coupling agent like 2% HPMC is used so that the hand held camera can be placed over the cornea. The operator adjusts the light intensity and changes focus to get a sharp image using foot switch controls. The settings can be changed to save still images or capture video recordings from which still images can be saved.

While recording the images, it is customary to first photograph the anterior segment, followed by the posterior pole, and then the retinal periphery in a clockwise manner. A topical antibiotic eye drop is inserted at the end of the procedure.

While beginners might find the procedure a little difficult initially, especially while holding the camera over the eye - after the learning curve, most trained personnel can save images with high accuracy and reproducibility. Due to the small eye size of preterm babies, sometimes it is cumbersome to place the heavy handheld camera on the small cornea. The eye speculum also adds to the difficulty of examination in very small eyes.

**Benefits of the Retcam**

Retcam offers a professional way to keep photographic records of ROP screening. The operator can easily view images of both eyes across the entire period of follow-up, compare images and decide if the disease is progressing or regressing.

Since it is a mobile self contained system, it can be shifted to any area where ROP screening is to be performed like the nursery, ICU, or operating room. After suitable training, the procedure can be easily performed by technicians or nurses, which can later be reviewed by an ROP expert.

Indirect ophthalmoscopy requires good skill, and more expertise is needed when coupled with scleral indentation. The Retcam makes the task much easier for the examiner, while making the procedure much faster and with less complications. It has demonstrated better cardio-respiratory stability during examination in children.

With the increase in medico-legal cases, it is essential to document fundus images very well. The Retcam helps to prevent inter-observer variability and is useful for telemedicine purposes and consultation with experts. It is much easier to teach residents and explain the disease process to parents with the retinal images.

**Fluorescein angiography**

Retcam assisted fluorescein angiography can be performed easily in the Retcam 3 (Figure 2a,b). Blue light is emitted by switching on the FA unit, and a yellow filter is inserted inside the camera hand piece. Sodium Fluorescein 20%
dye is injected intravenously (0.04ml/kg) via a preplaced intravenous cannula and the Retcam findings recorded. Excellent fluorescein angiography images can be recorded, which provide useful information for beginners.

The main advantage of fluorescein angiography is that it allows clear visualization of avascular retina and flat neovascularization which is not visible to the naked eye. It helps to detect missed areas of disease and skip areas of treatment, and is especially useful for visualizing the disease process in aggressive posterior ROP. While its indications are selective, it does provide useful information for the new ROP trainee.

**Telemedicine Role**

As digital imaging gets more common, tele-screening is going to get more popular. Retcam allows screening to be performed in peripheral centres by technicians, the images are then transmitted to experts based at tertiary eye centres, where they can review the images and advise treatment or follow up. This allows a large coverage area of the ROP screening program in the community.

Several reports in literature have compared Indirect Ophthalmoscopy with direct screening, and have found high sensitivity and high specificity in detecting referral-warranted ROP. Stanford University Network for Diagnosis of Retinopathy of Prematurity (SUNDROP) telemedicine initiative at 5 year results found Tele-medicine had 100% sensitivity, 99.8% specificity, 93.8% positive predictive value, and 100% negative predictive value for detection of treatment warranted ROP.

The Karnataka Internet Assisted Diagnosis of Retinopathy of Prematurity (KIDROP) program is a tele-screening program active across Karnataka, which follows the tripleT philosophy - Tele-ROP, Training of peripheral ophthalmologists and ophthalmic assistants, and Talking to neonatologists, pediatricians and gynecologists. It is a successful model for ROP screening in rural and semi-urban infants using tele-ophthalmology. With the advent of several dedicated mobile apps for ROP tele-screening, the images can be sent via the Retcam through the Internet and can be accessed by experts using mobile apps on smartphones.

Since Retcam is a very expensive equipment, it has limited its widespread use in telemedicine. Worldwide research is on to develop cheaper technology for tele-screening in the community. Low-cost technology for digital imaging in ROP will make tele-screening more universal and will go a long way in reducing ROP related childhood blindness in the community.

**References**