

Transforming Healthcare through Telehealth with Retcam by Increasing Procedural Safety for Early Screening of Retinopathy of Prematurity

Melissa Rice*

DNP Student Health Systems Leadership, Mount Saint Joseph University, Cincinnati, Ohio, USA

***Corresponding Author:** Melissa Rice, DNP Student Health Systems Leadership, Mount Saint Joseph University, Cincinnati, Ohio, USA.

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Abstract

Objective: The purpose of this study is to evaluate non-sedation protocols for eye screenings of premature infants with Retcam 3 to early screen and detect Retinopathy of Prematurity (ROP) and decrease timings to decrease adverse events.

Study Design: In a retrospective study of nurse driven teams with small sample size $n = 20$ at a Level III NICU August-December 2017 were analyzed to improve safety by decreased timings and non-sedation protocols to prevent adverse events providing a comfortable procedure. A general linear regression model were used to calculate effect with 95 % confidence intervals.

Results: Total patients $N = 20$ were reduction in timings by 20% with non-sedation protocols. $P < .05$.

Conclusion: This study found that Retcam 3 could be an effective tool via telehealth to early screen and detect (ROP) in premature infants safely and effectively with decreased timings on non-sedation protocols.

Keywords: Retinopathy of Prematurity (ROP); Information Systems (IS); ATA (American Telemedicine Association)

Defining telehealth and telehealth role

The use of medical information exchanged from one site to another via electronic communications to improve a patient's clinical health status ATA (American Telemedicine Association). The main hospital telehealth site has an information systems (IS) infrastructure that includes hospital steering committee and medical board that provides oversight to a telehealth center with physician champions in each department. Uses for telehealth include diagnosis and treatment, professional consultation with experts, and monitoring and care coordination. The telehealth IS role will help identify, develop and deploy telemedicine expertise, design program, workflow, technology, evaluation and reimbursement.

Clinical roles

A clinical champion is advised as gatekeeper for implementation and support, operational management, research support, and improving patient provider experience.

Ethical, legal, social issues (ELSIs)

A nonphysician licensed provider in state where care is provided to complete exam (RN/APRN) is required, a billable and reimbursable read per ophthalmologist, a letter of explanation of procedure is provided to parent after each procedure upon discharge which parent signs to acknowledge with witness information given, reminders included with follow up, and legal disclaimer provided to parent that missing a follow up appointment at discharge could

result in report to child protective services as this choice could lead to blindness should ROP develop without treatment required. Consents are obtained on admission for screenings including diagnosis, treatment, and management of infants with eye disease. It is also required to check your state board in state of procedure to ensure permission for IVI therapy. If your state does not permit this procedure can screen and refer only or obtain permission from your state board practice committee citing other state law as precedence. Our procedural technicians were APRNs with RN assist. March 1, 2016 for (IVI) therapy when law passed in Ohio for RN to perform Confirmed by Kentucky Board of Nursing at this time as well.

Disease burden

Vision loss and blindness from Retinopathy of Prematurity (ROP) is estimated at 1100 - 1500 premature infants each year in the United States (U.S.). Approximately 400 - 600 children may experience vision loss or blindness. Criteria included 30 weeks or less gestational age or birth weight < 1500 grams. First screening occurred at 32 weeks or 6 weeks chronological age whichever is later each Monday [1].

Mosheim and Frick [1] reports total eye disorder disease burden costs at \$139 billion and with \$50,000 adjusted per life year of disability adds an additional \$14 billion in the United States (U.S.) suggesting the need to improve universal eye screening. Ludwig, Callaway, and Moshfeghi [2] found that Retcam outperformed traditional ophthalmoscopy exam by the Ophthalmologist which had poor sensitivity (12.9%) and positive agreement (8.5%) for detection of conjunctival hemorrhage or other eye abnormalities when performing the newborn exam. About 90% of cases mature on own and will get referred to regular ophthalmology and 10% of premature infants will require medical or surgical intervention to treat ROP requiring and ROP specialist. Retinal detachments are 5% or less of treatable or non-treatable disease putting the patient at risk for blindness.

Rater reliability

Original Retcam studies displayed excellence in tool reliability. Kappa Statistic for Inter-rater accuracy and reliability .75 -1.0 indicating excellent agreement among clinicians [3]. Ells, *et al.* [4] 87% of ROP detected cases 23/44 by digital imaging occurred before or

at same time of indirect ophthalmoscopy. Sensitivity is 100% and specificity 96%, positive predictive value (PPV) 92% and negative predictive value (NPV) 100%. Overall is improving the management of early detection of ROP.

Program history and support for costs

Retcam through digital imaging at the point of care to enable earlier detection and treatment of ROP while including the ability to provide anti-VEGF treatment at the point of care using prior state as precedence for IVI therapy permission was pivotal for our Northern Kentucky Level III NICU at Saint Elizabeth in conjunction with Cincinnati Children's Hospital Medical Center. Retcam was intended for an early screening and detection tool but quickly we realized the capabilities and that RN/APRN driven teams could drive cost down, prevent morbidity of disease, and transfers to hospitals far from home. It quickly became a telehealth piece and was the first to propose and put in place for the NICU team at our Level III NICU. I saw this tool as the gold standard for care for ophthalmology to reduce loss of vision or blindness from ROP. The cost of disability from disease is much higher offsetting the cost of technology.

Methods

A local level III NICU in a small retrospective study in August-December, 2017 for this study with Retcam and technicians could be trained easily by Product Reps to perform Retcam screenings at 32 weeks and < 1500g or 6 weeks chronological age from birth.

You can easily find simple abnormalities like a corneal scratch which usually goes away on own with fluorescein stain drops to eye to identify. ROP regression reoccurrence infants are at risk for until about age 5 years so require follow up with ophthalmologist who is an ROP expert at our main facility. Other common findings may be retinal hemorrhage from birth trauma, disease, or therapy but often resolves on own, if not or worsens can be treated with laser/cryotherapy.

The licensed RN/APRN will send completed images sought at required screenings and recommended follow ups to the ophthalmologists at the main facility to be read by their ROP experts and then follow up is recommended according to disease level with screenings typically every 1 - 2 weeks in frequency. Retcam views include left and right eye inferior, superior, posterior, temporal and

nasal views including first external picture of the eye after numbing with dilatation.

The key components of my research focus of non-sedation protocols and decreased timing for safe uneventful procedures with Retcam as a screening and or 77 treatment tool offering effective service to decrease cost/disease burden, increase revenue for our department, while keeping our clients at their outlying facilities. Procedure on non-sedation protocols using numbing and dilatation drops reduces risk of adverse events. Some folks use injectable lidocaine after numbing, dilatation drops, and sterilization of site after speculum placement. Our comfort measures included developmental recommendations, bundling, pacifier, or sucrose nipples of 24% such as Sweet-Ease of .5 ml effective to control any discomforts before during and after the procedure. Sweet-Ease is often dosed 15 - 20 minutes before sublingual if competent nippler with repeat times one in 15 - 20 minutes into procedure if needed. If contraindicated just non-nutritive sucking is recommended NPO to prevent aspiration risk per ophthalmologist recommendation. We found no risk or side effects and no adverse events related to our procedure except one allergy patient to lidocaine. With removal of lidocaine there was no adverse effect.

Antisepsis per ophthalmologist. Needles available for IVI therapy are approximately 32 gauge and 4 mm [5]. The anti-VEGF medication is administered in the vitreous humor of the eye laying in the body of the eye or fundus in front of the retinal vessels typically at a depth according to ophthalmologist directions. It is important to avoid the four corners of the eye where the muscle is and control depth and angle to avoid hitting retinal vessels or optic nerve. I found these complications not a worry but a mere explanation for our injection methods and increased patient comfort.

On days for screenings only, it is not necessary to use injectable lidocaine at all. This is reserved and optional per ophthalmologist order only if permitted to do IVI therapy.

Caveat

Infants may only maintain attention span for about 10 minutes so important to get views quickly required for screening, make sure proper prep is placed, procedure performed with assistance by another RN as holder to offer comfort, and keep the infant content and organized to complete in a timely fashion. If it takes 10

minutes for one eye then give brief break, reorganize infant, and go to other eye.

Aqueous chlorhexidine .1% before and after IVI therapy recommended as superior to providine-iodine (Wood and Harper, 2021).

With smaller needle size of 32g 4 mm and technique posterior to limbus .75 - 1.0mm TSK Steriject needle in premature infants for IVI therapy we found no risk for cataracts, vitreous hemorrhage, endophthalmitis, corneal infection updated from prior recommendations of 1.5 - 2 mm additionally removing risk of retinal detachments [6].

Use nasal prong continuous positive airway pressure (CPAP) versus mask if in use to prevent blowing and infection risk during eye screenings [6].

If persistent irritability post procedure can use Tylenol or Ibuprofen non-narcotic measures PRN if scoring for pain on NIPs greater than 3. We found our NIPs score 0-3 not requiring additional pain control. Always offer comfort measures first and follow pain score recommendations. This should not be needed on screen and refer day.

Results

In total 20 cases per month are referred to CCHMC ROP clinic. We found with comfort measures, non-sedation protocols, and decreased timing by 20% in procedures we had a safe comfortable procedure and inter-rater reliability of excellent quality at .8 Kappa Statistic. Our p value was < .05 with 95% CI; Z score 1 Phi 2 Infants are content and stable. Keeping rooms quiet with decreased lighting is helpful with good picture quality and procedural comforts. We found retinal detachments about 1 - 2% under the national average and treatable disease under 10% at 08%. Our sensitivity of 97% and specificity 100% was consistent with industry standards for detecting treatable disease or mature without disease.

Discussion and Conclusion

We found screening with Retcam offered comfort to our patients, decreased costs of care, and decreased risk for adverse events due to non-sedation protocols, comfort measures, and decreased timing. Better screening protocols decrease morbidity and

disability from ROP with earlier intervention and treatment per the AAO. Suggestions for future studies include improved screening guidelines and earlier intervention with ophthalmology specialists in ROP management leading to improved outcomes for ROP. The AAO [7] current recommendations for screening include: to screen if less than 27 weeks at 31 weeks, if greater than 27 weeks -30 weeks, older gestation, and high risk screen at 4 weeks chronologically from birth and < 1500g [8,9].

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