

Telementoring: How Technology is Helping to Lower the Impact of ROP in Armenia

High-bandwidth, high-resolution platforms allow experts to observe the surgical field remotely, as though they were there.

BY THOMAS LEE, MD

In some developing countries, there is a shortage of experienced doctors who can diagnose and treat retinopathy of prematurity (ROP). This is partially because, in earlier times, premature infants rarely survived long enough to develop the disease, and hence there was no opportunity to learn how to care for them.

Over the past 10 to 15 years, one particular developing nation, Armenia, has begun to build a sophisticated health care infrastructure, including the establishment of neonatal intensive care units (NICUs). NICUs allow health care providers to rescue and save many premature infants; however, without the full complement of experience, providers at these facilities were not prepared to treat the complications and diseases, such as ROP, for which these infants are at risk.

AN EPIDEMIC IN ARMENIA

In Armenia, almost 60% of infants in NICUs will develop some form of ROP, and it is estimated that one in 10 children will develop significant ROP requiring treatment. In the absence of treatment, these infants will eventually go blind. Until recently, almost 100 babies born each year in Armenia were never diagnosed in the NICUs, only to later present to pediatricians' offices completely blind. This epidemic was so profound that ophthalmologists in Armenia reached out to the Armenian Eye Care Project and notified them of the epidemic of blind infants. These Armenian ophthalmologists suspected the infants were blinded by ROP, but they had never seen the condition before, and, with no training, were not able to diagnose or manage it.

THE ARMENIAN EYE CARE PROJECT

I became involved in this situation after being contacted by Roger Ohanesian, MD, president of the Armenian Eye Care Project. In an effort to address this need, I and a team of fellow ophthalmologists including R. V. Paul Chan, MD, MSc, and Michael Chiang, MD, established a training program that allowed us to train and mentor doctors remotely using a wide-angle pediatric imaging system (RetCam, Clarity Medical Systems).

At a Glance

- Telehealth may be a mechanism to facilitate more efficient and better delivery of medicine across the continuum of care, and recent technological advances are making remote screening and diagnosis an increasingly viable option.
- A pilot study demonstrated the utility of ultra-widefield imaging for detection of diabetic retinopathy, in some cases detecting patients in need of further follow-up who might otherwise have gone undiagnosed and untreated.
- Although regulatory, economic, and technological obstacles remain, the wider adoption of telehealth programs would seem in line with a renewed interest in health care to integrate low-cost, high-yield standards of care.

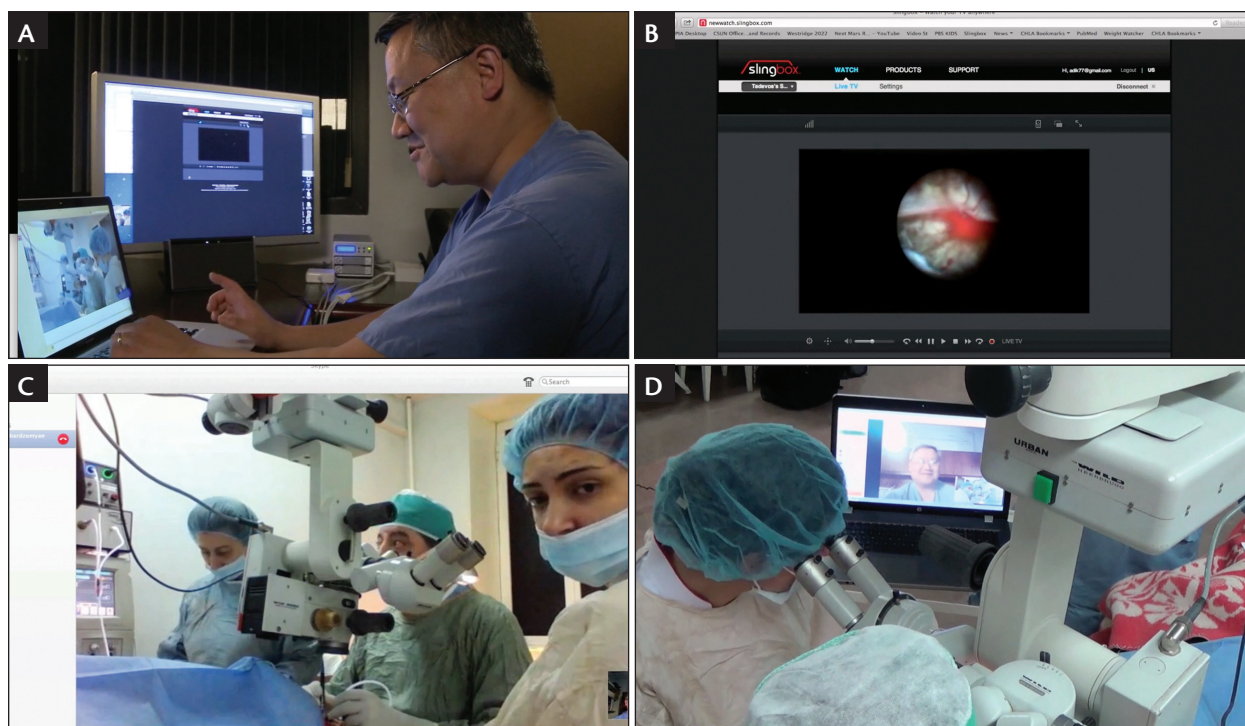


Figure. Through the use of Slingbox technology, Dr. Lee is able to remotely view a surgery in Armenia from his home office in the United States (A). Multiple views allow simultaneous viewing of the overall surgical view (A) and the view from the microscope (B). It is a live stream, permitting the surgeons to have real-time feedback from Dr. Lee when necessary (C). In a situation similar to the one depicted in figure D, the program began with S. Chien Wong, MD, in the OR instructing the training surgeons on the mechanics of the surgery while Dr. Lee focused on the surgical strategy, thus providing the training surgeon who viewed the procedure through the training oculars the benefit of two expert surgeons teaching the procedure. Today, the mentorship continues with local surgeons training a new batch of surgeons on how to intervene in cases of ROP.

As part of this program, Armenian pediatric ophthalmologists performed examinations with a standard indirect ophthalmoscope and then photographed the fundus using the RetCam. They would enter their diagnosis into an online database and upload the corresponding images. We would then review the images, make a diagnosis, and reconcile the diagnosis they made using indirect ophthalmoscopy with what we were observing on the RetCam images. By doing this over the course of a year, we were able to train Armenian ophthalmologists to a level of accuracy that was equal to that of an experienced ROP screener in the United States.

There were some children who still eventually went blind, even with proper diagnosis and treatment; these children were being transferred to St. Petersburg, Russia, but we quickly realized that flying a profoundly premature infant on ventilation to a remote city was not ideal. To address this situation, Armenia's minister of health requested that we train local ophthalmologists to perform surgery over the Internet in much the same way we had trained them to diagnose and treat these infants with laser.

ENDOSCOPIC SURGERY FOR ROP

As a pediatric retina surgeon, I have found that the Endo Optiks laser endoscopy platform is exceptional for identifying structures, diseases, and scar tissue in eyes in which (1) there is a limited view or (2) the scar tissue or the pathology is in an area that is not accessible with a standard wide-angle viewing system using a traditional microscope and lens. Because the endoscope allows one to place the viewing system directly onto the eye, the surgeon can visualize the surgical field in remote parts of the eye that would normally be beyond the reach of a standard viewing system, notably, structures behind the iris at the ciliary body or at the vitreous base.

An ability to image this particular region of the eye is necessary for pediatric retinal detachments associated with ROP. Using the endoscope, the surgeon is able to clearly see the insertion of the scar tissue on the retina as well as the lens capsule and anterior vitreous base. This makes tissue dissection much safer and more accurate and reduces the likelihood of creating an iatrogenic break with a vitrector. The coaxial lighting system of the endoscope

highlights vitreous and membranes that would otherwise be difficult to identify. The improved visualization, the ability to image the most anterior portion of the eye, and the clear view it provides make endoscopy a useful tool in managing these very complex retinal detachment cases.

Establishing a pediatric retina training center for ROP in Armenia was a challenge because all the retinal surgery equipment was located in ambulatory surgery centers (ASCs). It is not ideal to have a neonate go under anesthesia in an ASC setting because of the risk of the child arresting or having some other complication. Instead, we brought the surgical suite into the NICU itself. The Armenian Eye Care Project partnered with the United States Agency for International Development (USAID), and, with a \$1 million grant, was able to create a retinal surgery suite in the labor and delivery department at the Republican Hospital in Armenia.

Working with S. Chien Wong, MD, of Moorfields Eye Hospital and the Great Ormond Street Children's Hospital in London, we have developed a platform that allows us to perform real-time surgical proctoring using an off-the-shelf video streaming device called a Slingbox that can broadcast surgeries over the Internet (Figure). Using this device, we are able to mentor the surgeon remotely and engage in real-time discussion with the doctors. We have already remotely mentored the performance of several surgeries on premature infants thus far and are continuing to optimize the platform with the hope that this kind of surgical training can be scaled to other sites as well.

CONCLUSION

How surgeons are trained has not changed from the time of William Halsted in 1880. The training of surgeons today follows a long tradition of direct one-on-one apprenticeship. Very little has changed over the past 130 years, despite all the advances in technology and communication. Our field is now at an inflection point, where demands in the developing world for more expertise are intersecting with the requirement that they be low-cost. High-bandwidth disruptive devices and platforms allow expert surgeons to be present remotely with a resolution that allows them to observe the surgical field as if they were actually there, in effect extending the ability to continue the one-on-one mentorship that has advanced the field of ophthalmology to the present day. ■

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