Guest Editorial

The changing scenario of retinopathy of prematurity in middle and low income countries: Unique solutions for unique problems

Retinopathy of Prematurity (ROP) is one of the leading causes of preventable infant blindness around the globe.[1] Over the past 70 years or so, since it was first described in 1942, major advances in understanding and managing this disease have led to an interesting dichotomy in the global manifestation of ROP.[2]

On one hand, high-quality neonatal services, better equipment, evidence-based screening protocols and improved training and access to ROP specialists in high income countries means that blindness due to ROP can usually be averted in these settings. On the other hand however, the situation is different in middle-income and low-income countries where birth rates in general and rates of preterm birth are high.[3] Many of these countries are expanding neonatal services, albeit sometimes with suboptimal care, leading to an increase in neonatal survival. However, ROP screening and treatment are either not universally available or not of sufficient quality, thus exposing the majority of the 'at-risk' premature infants to the risk of irreversible and permanent blindness.[4]

Blindness from ROP has been described in three 'epidemics'. The 'first' epidemic occurred in the United States of America and Western Europe in the 1940s and 1950s. This was due to the use of unmonitored 100% supplemental oxygen for treating premature infants which led to the epidemic of blindness due to 'retrolental fibroplasia'. It later subsided with the restricted use of oxygen supplementation.[4] Subsequently, with advances in neonatal care and increased survival of smaller and less mature infants in the 1970s and 1980s, another wave of visual loss from ROP began, leading to the 'second epidemic'.[5,6] These epidemics taught us that ROP is multifactorial and that oxygen is not the sole culprit.[6] It also led to the international classification[7] and a landmark randomized controlled trial (CRYO-ROP) which established a treatment protocol that reduced the risk of blindness in infants with threshold disease.[8]

Many middle-income and low-income countries are experiencing rapid financial, social and medical progress. Several Ministries of Health are expanding services for neonates—including those born preterm—given the recent realization that neonatal mortality contributes significantly to under 5 mortality. However, many of these initiatives do not incorporate control of the complications of preterm birth, including ROP, as relevant policies and guidelines are often not in place. This has led to what has been described as the "third" epidemic of blindness due to ROP, initially in Latin America.[3] Indeed, a meta-analysis suggests 32,300 preterm infants are becoming blind or visually impaired every year, and that the 3rd epidemic has spread to other regions, including India and China.[9] Asia is now the region with the highest estimated incidence, where rates of visual loss from ROP are over twice as high per million live births as in established market economies.[10] The higher rate can be attributed to 3 factors: high preterm birth rates, suboptimal neonatal care which places more mature infants at risk, and inadequate coverage of high quality programs for the detection and treatment of sight threatening ROP.

In many middle-income and low-income countries ROP is now the commonest cause of avoidable blindness in children, and large numbers of infants with Stage 5 disease are presenting to tertiary eye care departments when it is too late to restore visual function.[11] Many countries in the vanguard of the third epidemic are responding—particularly in Latin America, Eastern Europe and in the Middle East—by expanding coverage for detection and treatment, by instituting policies and initiatives to improve neonatal care, and by producing national guidelines.[12-14]

The poorest countries, notably those in Sub-Saharan Africa, which had hitherto not experienced the scourge of ROP because of poor survival of their premature infants are now reporting blinding forms of the disease,[15-18] and several countries are responding by initiating ROP screening services. Simultaneously, within large countries like India and China—which together constitute almost half of the world's population—ROP is also being reported in infants cared for in more rural areas whereas previously only urban babies survived.[19,20] These pose several new challenges, namely, 1) an unknown disease burden; there are no community based surveys and the electronic hospital records are not integrated to measure the actual burden; 2) a very large 'at-risk' population which includes heavier and more mature infants;[21] 3) limited ROP experts to handle the burden.[22] In a country like India, with over 20,000 ophthalmologists, less than 150 actively practice ROP management[23] and even in centers where there is increasing awareness, there is a lack of infrastructure to manage the disease; 4) lack of awareness in the pediatric and nursing cadres which prevents babies from timely screening in the neonatal unit or timely referral to a center where such a facility is available;[24] and 5) logistical difficulties in setting up screening programs. In India for example, over 700 Special New-born Care Units (SNCUs) have been established by the Government in district hospitals, but policies and programs for ROP have not yet been included. Government programmes often lack monitoring and evaluation systems; 6) Rural babies are therefore at the bottom of the pyramid of care and often present late with more advanced forms of disease.

Unique Problems Require Unique Solutions

To rapidly increase ROP screening coverage, it may be necessary to consider a paradigm shift of the 'owners' and 'operators' of screening programs.

1) Where available and possible, neonatologists and pediatricians or the staff providing services to these preterms should increase 'ownership' and begin screening for ROP and refer the infant when high risk features develop or when treatment is required. This would be possible if low cost infant retinal wide-field cameras are available that allow bedside image capture and prompt reporting and referral to the expert.[25]

2) Wherever there are lack of experts, tele-ROP services that employ non-physician 'operators' who travel to designated units to screen infants using wide-field cameras supported by tele-medicine would enable large geographic regions to be covered even in the absence of ROP specialists. One such successful strategy to address ROP in rural areas lacking in awareness, screening programs and experts has come from Bangalore, India.[20,26,27] A tele-ROP program, called KIDROP (Karnataka Internet Assisted Diagnosis of ROP) has been providing ROP screening and subsequent treatment using an indigenously developed tele-medicine network. The program has trained a cadre of accredited technicians not only to capture retinal images, but also interpret and report them live using a simple triaging algorithm.[20,26] The images are also viewed near real time by the remotely situated experts on his or her smart phone, providing the report and management decision within minutes, allowing the family of rural infants access to the specialist remotely, which would not have been possible otherwise.[27] Over 45,000 infants (imaged over 140,000 sessions) from 126 centers spread across the South Indian state of Karnataka have been screened and over 2250 have been treated with the help of this method.

A scope for improvement in the existing strategy would be: 1) a universal screening program[28] built on the tenets of tele-medicine employing low cost, easy to use, portable infant imaging cameras,[29] an accredited training program that employs a cadre of trained technicians and an integrated reading center that will provide credible and rapid diagnosis with reports for these remote screening sites which comply with clinical and medico-legal regulations.[30] This has the scope of preventing blind-person years (BPY) accounting for over 200 million USD annually in ten states of the country[31] 2) Software innovations providing fully or semi-automated analysis of retinal images providing a clinical triage, machine learning, deep learning algorithms and artificial intelligence will allow better utilization of the limited number of specialists.[30] 3) Adopting a paradigm shift in the screening program from an ophthalmologist led system to a paediatrician led system that employs low-cost ROP cameras stationed in the neonatal unit and linked via the internet to the local eye specialist.[25]

As we begin to face these new challenges, we must remember that only a concerted team effort by neonatologists, pediatricians, ophthalmologists, gynecologists, nursing professionals and parents, and now a new breed of technicians, photographers, researchers, community scientists, biomedical and software engineering professionals can stem the scourge before it overwhelms us.

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