Modern Surgery for Global Cataract Blindness

Preliminary Considerations

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Unoperated cataract in the developing world remains ophthalmology’s major unsolved problem. Recent developments have brought into question the assumptions of those who have thought that extracapsular surgery with implantation of a posterior chamber intraocular lens is an unrealistic approach to the treatment of global cataract blindness. High-quality 1-piece posterior chamber intraocular lenses are being manufactured locally for approximately $10 each. Most ophthalmologists can be trained to perform extracapsular surgery in a 1-month course. This process is particularly effective if outstanding local surgeons receive intensive training to become instructors. While the incidence and treatment of posterior capsule opacification requires further study, the development of a low-cost YAG laser may be a solution. Imaginative ways to recover costs will need to be developed if the staggering prevalence of cataract blindness is to be effectively addressed. The improved result of modern surgery may make patients more willing to pay for their operation.


Few indicators reveal the difference between the world’s rich and poor nations as starkly as the prevalence of curable diseases like cataract blindness, which has been virtually eliminated from developed countries. In contrast, there are an estimated 16 million persons with cataract blindness in the developing world, representing 42% of total world blindness.1 This number will increase as the elderly population in these countries increases. The World Bank has assigned cataract treatment programs a high priority because of their cost-effectiveness in reducing disease burden.2 Previous treatment strategies, employing mainly intracapsular cataract extraction (ICCE) by local ophthalmologists supplemented by occasional visits from western surgeons who themselves performed most of the surgery, have not even stemmed the rising incidence of the disease, let alone addressed the backlog.

Extracapsular cataract extraction (ECCE) with the implantation of a posterior chamber intraocular lens (PCIOL) is beginning to replace ICCE as it did in the developed world 20 years ago.3-6 The ECCE–PCIOL implantation procedure gives a better result and has a lower rate of complications. By raising surgeons’ self-esteem and patients’ willingness to pay for surgery, it is anticipated that the superior result of the ECCE–PCIOL implantation procedure will increase the rate of cataract extraction.

The cost of good-quality PCIOLs is decreasing because of local manufacture in facilities such as the Aurolab IOL factory, Madurai, Tamil Nadu, India, and the Fred Hollows Foundation factories in Eritrea, and Nepal. Another facility is under construction in Vietnam. Run by local managerial and technical staff, these factories have shown that the highest international standards for the manufacture of medical supplies can be achieved in the poorest corners of the globe.

The Fred Hollows Foundation factories are manufacturing 160,000 one-piece, equiconvex PCIOLs per year at $7 to $10 each (US currency). At this price, the factories cover their costs, including provision for equipment maintenance and replacement. Preliminary testing by several independent agencies has confirmed that the IOLs (FH106, Fred Hollows Foundation) meet or exceed international regulatory standards for surface quality and op-
tactical resolution (US Food and Drug Administration), sterility and ethylene oxide residue testing (NAMSA, Northwood, Ohio), and mechanical testing in accordance with ISO/DIS 11979-3 draft international standard (Lenstec, St Petersburg, Fla). Accreditation of the Nepalese factory for European Standard EN 46002 is under way; the Eritrean factory will follow in 1998.

Surgeon training can be achieved through courses that are designed to train physicians and ophthalmic surgical nurses selected by local authorities to the level of instructors. These instructors then train their colleagues. Skill transfer such as this is one of the most effective ways for ophthalmologists from the developed world to help reduce global blindness.7

The extent of training depends on the skill and experience of the students. In Vietnam, for example, many experienced ophthalmic surgeons were available who had to convert from ICCE to ECCE with an operating microscope. Through the efforts of cataract instructors who were trained in courses held in 1992 to 1994, there are 350 practitioners of modern cataract surgery throughout the country, 200 of them operating unsupervised. These courses typically last 2 to 3 weeks. In Eritrea, only 1 ophthalmologist was trained as an instructor. Because of the lack of medical manpower, 7 nonmedically qualified ophthalmic assistants have been successfully trained as “cataract surgeons.” This program lasted 2 years in affiliation with the University of Asmara, Asmara, Eritrea. Teaching is facilitated by standard operating procedure manuals, which have been published for the ECCE–PCIOL implantation procedure and the management of complications,8,9 and portable teaching microscopes with a side arm and coaxial closed circuit television.

The national conversion to the ECCE–PCIOL implantation procedure is a gradual process designed not to disrupt, but rather to augment and improve, existing treatment programs. A transition phase of ICCE with anterior chamber IOL implantation was not required. The move to modern surgery was greeted enthusiastically by surgeons and has been associated with an increase in the rate of cataract surgery in both countries.

Competent surgeons are supplied with a microscope, instruments, and PCIOLs at the end of the course. Those who require further training continue to operate only under supervision. Quality assurance is facilitated by follow-up tours by cataract instructors and representatives of the nongovernmental organization, as well as by the use of standardized patient tracking cards. Computerized databases are well within the reach of most centers.

Essential equipment, such as operating microscopes, microsurgical instruments, cautery, and autoclaves, is available at a reasonable price from several sources. Specific equipment maintenance programs are required. The formulation of generic pharmaceuticals and intravenous fluids for intraocular irrigation is relatively straightforward, so these are usually available at a low cost from local manufacturers.

Few data exist on the incidence of posterior capsule opacification in the developing world, but it may be less than that in the developed world (≈20% of the cases10) if the proliferative potential is reduced in residual epithelial cells of the more advanced cataracts that are found, even in the younger patients. Even when posterior capsule opacification does occur, the quality of vision may still be better than that attained by intracapsular cataract surgery with the standard +10 aphakic spectacles, which are often lost or broken.11,12 A recent survey of the first cases performed by Vietnamese ophthalmologists newly trained in the ECCE–PCIOL implantation procedure found significant posterior capsule opacification (reducing visual acuity to ≤20/60) 1 year after surgery in 5% of the cases.13

It is not yet clear how significant posterior capsule opacification in the developing world should be treated. Primary capsulotomy after insertion of the IOL is an option but leads to vitreous liquefaction, which increases the risk of retinal detachment and cystoid macular edema.14 The risk of these complications would still be less than that associated with ICCE and the insertion of an anterior chamber IOL using loupes. Secondary capsulotomy is likely to benefit the patient if opacification can be seen behind the pupil, if the optic disc is blurred on direct ophthalmoscopy, and if the visual acuity is significantly reduced (≤20/60). Needle capsulotomy, an affordable procedure, is possible through either the limbus or the pars plana; however, it is another intraocular procedure with attendant complications. YAG laser capsulotomy is quicker, safer, and easier. A recent cost-minimization analysis suggested that laser capsulotomy became more economical than primary capsulotomy when a particular unit performed more than 1000 ECCE–PCIOL implantation procedures per year.15

A major research and development project is under way to develop a low-cost YAG laser for field use. Many of the less essential features of available models are being discarded to build a robust model for $10 000 to $12 000 (US currency). The challenge of low-cost ophthalmic suture production is also being faced with the adaptation of manufacturing and packaging technology, although developments in manual nucleus-dividing surgery could ultimately make large-scale sutureless small-incision cataract surgery a reality.

Funding for cataract eradication programs must ultimately be generated by the nation if sustainability is to be ensured and programs are to have any real effect on the rising incidence of cataract blindness. Fee-for-service programs are probably the most appropriate and efficient way to accomplish this. With cheap PCIOLs, the cost differential between ICCE and ECCE with IOLs is much reduced. Fixed and capital costs for programs must also be calculated and met to ensure long-term viability and to allow for the purchase of replacement equipment. Flexibility in pricing, pioneered by Aravind Hospital, Madurai, will improve access to more disadvantaged groups. As with laser capsulotomy, the cost of a single operation declines as the number of cases a unit performs per year increases.

Good data relating to the economic viability of extracapsular programs in poor regions is not available, but anecdotal evidence is encouraging. In January 1992, approximately 10% of public patients at Aravind Hospital who were offered ECCE with free aphakic spectacles opted to buy a PCIOL for 500 rupees (≈$14, US currency). By December 1993, 60% were taking that option (G. Venkataswamy, MS, written communication, September 19, 1997). The Fred Hollows Foundation African program
has experienced similar results. The extended family concept, found all over Africa, tends to cushion the difficulty of a poor person finding the $15 per lens that we suggest eye care programs charge. If lenses are available for $7, the additional $8 profit will allow some subsidy for the really poor if properly managed.

We believe that the empowerment of local people to solve their own problems is a key to the eradication of global cataract blindness. Extracapsular cataract extraction—PCIOL implantation is more attractive to patients and stimulates surgeons. High-quality PCIOLs can be made cheaply in the developing world, and local personnel can be trained to insert them safely and well. While more research and analysis of economic constraints at the level of the community is needed for all cataract treatment programs, the use of modern cataract surgery in developing countries may solve more problems than it creates.

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