

## Public health ophthalmology

Preventive eye care programs in developing nations teach health care workers to diagnose and treat ocular or systemic diseases or conditions that can cause serious visual disability and blindness if left untreated. The concepts involved in these programs are often amazingly simple; a clean water supply and basic personal hygiene are important to any successful preventive eye care program. In addition to eye care workers, several other types of health practitioners are important in such programs, including integrated primary health care workers, public health nurses, and midwives.

Curative medicine also plays a vital role in reducing blindness rates in developing nations. Cataract, which accounts for almost half of the world's blind, is a surgically curable disease: permanent loss of vision and complications of advanced cataract can be prevented by cataract surgery. Although low vision and blindness from glaucoma cannot be restored, medical and surgical treatment can stop further loss of vision from glaucoma.

The concept of blindness prevention by curative means is exemplified by cataract surgery programs on the Indian subcontinent, where many millions of people are blind from cataract. Many thousands of patients undergo sight-restoring cataract surgery every year through surgical campaigns. These campaigns attract patients who are blind from a variety of causes. All people with eye complaints who attend are carefully screened and diagnosed. Advance publicity ensures large patient attendance for examination and treatment.

Campaigns are often held in remote and underserved areas. Hundreds, even thousands, of cataract operations may be performed during a single campaign.

Indigent patients are provided basic but quality sight-restoring surgery. Eye surgeons volunteer their time and skills, community service organizations provide financial support, and patients learn to fully utilize this unique health service. The surgical cataract campaign is an excellent example of close community cooperation in meeting a public health problem.

## Preventive eye care

This section summarizes some of the largest categories of sight-threatening problems facing the developing world (aside from cataract) and possible public health approaches to their effective management. (Defining terminology is given in the respective chapters and the glossary.)

### Trachoma

Prevention of blindness in trachoma is possible through early diagnosis and treatment, improved personal hygiene (hand and face washing) (1), and identification of patients with entropion and trichiasis. Corrective eyelid surgery for trichiasis should be performed as soon as possible to prevent further corneal complications. Screening for trachoma can be performed at health stations in villages, at schools, and at prenatal clinics. Particular attention should be paid to children younger than 5 years of age, because they are at high risk of infection in places where trachoma is common. Trachoma control programs involve public health planners, educators, and surgical technicians. Ophthalmologists serve as teachers and perform trichiasis surgery as necessary.

### Ophthalmia neonatorum

Prevention of blindness from conjunctivitis of the newborn is achieved by instillation of tetracycline 1% ointment or penicillin drops into the eyes of all newborns. Silver nitrate solution also may be used for pre-



1 Village water point, Lower Shire Valley, Malawi. The availability of fresh, clean water is essential in the control of waterborne communicable disease and trachoma.

vention of neonatal infection. Be aware that a bottle of silver nitrate left sitting at a window in sunlight can evaporate, causing the solution to become more concentrated. Concentrated silver nitrate solution, if applied to the eye, can cause permanent corneal scarring.

If the mother of a newborn is known to be infected with gonorrhea, she should be treated with systemic penicillin in appropriate dosages; her child should be carefully observed for signs of acute conjunctivitis and, if conjunctivitis is present, treated with systemic penicillin and topical penicillin drops. All midwives, nursery attendants, nurses, and doctors should be taught the proper use of tetracycline ointment, penicillin drops, and silver nitrate.

### Conjunctivitis and corneal ulcer

Education of the public about the importance of seeking care for a red or painful eye (and avoiding the application of damaging traditional eye medications) is very important in preventing ulceration of

the cornea and corneal scarring. An ulcer may follow a seemingly minor injury to the cornea, such as a corneal abrasion. All corneal injuries must be treated promptly to prevent corneal scarring or perforation. All health care workers should understand the importance of early treatment and early referral of an infected eye.

### Eye injuries

Ocular trauma and consequent blindness may be prevented by the following means:

- Education programs concerning ocular safety (examples: automobile seat belts to prevent facial and ocular injuries in a collision; avoiding looking directly at the sun or a solar eclipse; using safety goggles while hammering on metal or grinding metal in a machine shop).
- Enforced safety regulations, including protective eye wear, for all workers in industry who are exposed to working conditions where eye injuries are likely to occur.
- Prompt and correct treatment of all eye injuries.

## Glaucoma

Prevention of primary open-angle glaucoma, the most common type, is not possible because its cause is not known. Once primary open-angle glaucoma or other glaucoma has been diagnosed, prevention of further loss of vision and blindness is possible by medical and surgical means, as described in Chapter 6.

Early diagnosis and treatment are essential for such a program to be successful. This is a great challenge, because it means examining the entire population. Because glaucoma is more likely to occur after the age of 40 years, screening with tonometry and examination of the optic nerve should be performed on all people aged 40 years and older.

Mass glaucoma screening campaigns can identify new cases needing medical and surgical management. Education of adults about glaucoma can identify further cases; many individuals who could have maintained useful vision if they had been diagnosed and managed earlier appear for treatment of glaucoma at a far advanced stage of the disease. Glaucoma should be suspected in any case of unexplained visual loss.

Primary angle-closure glaucoma cannot be prevented except by providing a surgical iridectomy (removal of a tiny portion of peripheral iris) or iridotomy (making a tiny hole in the iris with a laser), both impractical and expensive to perform on everyone at risk. Angle-closure glaucoma patients undergoing an acute attack have distinct pain and loss of vision; early and correct management of such cases will preserve the eye and vision.

## Amblyopia

Prevention of esotropia and exotropia is not possible, but if identified and treated early, visual loss from amblyopia ('lazy eye') resulting from strabismus (squint) may be restored. The earlier the treatment, the better; if a child has not been treated before the age of 6 years, the chance of regaining vision is poor. A high refractive error in only one eye will also cause amblyopia as the patient comes to depend on the other eye. School vision-screening programs can identify children needing attention.

## Nutritional blindness

**Vitamin A deficiency and malnutrition** – marasmus, kwashiorkor, and combined protein-energy malnutrition (PEM) – are major causes of preventable childhood blindness in many nations (Chapter 4). High mortality rates are associated with these conditions; permanent damage occurs in those children who survive. **Vitamin A deficiency (xerophthalmia) and keratomalacia** should not be considered isolated conditions because they are often only one aspect of generalized malnutrition or starvation.

Several countries (Indonesia and Malawi, for example) have developed national and local programs to address the problem of nutritional low vision and blindness. These programs include surveys to determine the extent of the problem, intervention programs that distribute vitamin A, and programs that improve dietary habits and agricultural practices.

In these and other programs, maintenance dosages of vitamin A are administered to children under 5 years of age; medical assistants trained in recognition of the signs of malnutrition work at the village level to treat and refer patients; and children with malnutrition, diarrhea, and acute febrile illnesses – particularly measles – are treated intensively.

## Onchocerciasis

Onchocerciasis ('river blindness') is described in Chapter 9. In Central and West Africa, the disease is responsible for high rates of low vision and blindness.

Blindness from onchocerciasis cannot be reversed. The opportunity to eliminate blindness secondary to onchocerciasis lies in controlling the vector, the *Simulium* black fly, and thereby controlling transmission of the *Onchocerca* parasite and in the prevention of blindness by community ivermectin chemotherapy treatment.

## Corticosteroid use

Corticosteroids, applied topically to the eye in the form of drops or ointment and taken systemically, may have serious ocular side effects. Only one positive effect may result from the use of corticosteroids in ophthalmology, and that is the reduction of external and intraocular inflammation in patients where such drugs are truly indicated, such as in uveitis and post-operative surgical inflammation. Many potentially blinding side effects can result from indiscriminate use of corticosteroids in situations in the developing world where there are few other medical and surgical resources.

Some of these situations, where simple withholding of corticosteroids constitutes preventive care, are described below:

- **Cataract.** Opacity of the posterior area of the lens (posterior subcapsular cataract) can result from prolonged corticosteroid use in any patient, young or old. The cataract does not resolve or disappear when the medication is discontinued. Corticosteroid cataract may be caused by both topical and systemic corticosteroids.

- **Dendritic keratitis** secondary to herpes simplex. This frequently results when corticosteroids are given to patients with red eyes where a diagnosis has not been established. Corticosteroids can cause herpes simplex virus to invade the cornea and can cause the infection to become worse. All patients with external eye infections should be checked with fluorescein dye for corneal herpes simplex infection. *Topical corticosteroids should never be given for a patient with a dendrite corneal staining pattern.*
- **Glaucoma.** Long-term use of corticosteroids can elevate intraocular pressure and cause subsequent glaucomatous optic nerve damage. To prevent loss of vision from this side effect, routine and regular tonometry should be performed on all patients receiving topical or systemic corticosteroids. Discontinuing these drugs will usually allow intraocular pressure to return to normal. If intraocular pressure does not return to normal, the patient should be followed for ocular hypertension and possible glaucoma.
- **Bacterial corneal ulcer.** In general, topical corticosteroids should not be administered to an eye with a bacterial corneal ulcer. The infection can worsen and corneal perforation with loss of the eye may result.
- **Fungal corneal ulcer.** Administration of corticosteroids to a cornea that has sustained an injury with vegetable matter (a wood splinter or rice or maize chaff, for example) may result in a fungal corneal ulceration. Such an ulcer is extremely difficult to treat and frequently results in a blind eye.
- **Corneal abrasion.** Topical corticosteroids should never be used to treat a corneal scratch or abrasion. Bacterial or fungal corneal ulcer can result.

## Primary health care and primary eye care

An international meeting of health experts in Alma-Ata in the then-USSR in 1978 outlined a major policy for meeting community health needs. The Alma-Ata declaration (the most recent of its kind) defines primary health care as 'essential health care based on practical, scientifically sound, and socially acceptable methods.' Since the Alma-Ata meeting, greater emphasis has been placed on primary health care program development.

Primary health care is community based. It is dependent on community involvement and participation. Health care workers, sometimes chosen by communities, serve to promote better living conditions and improved health through public health education, teaching good hygiene, and improving waste disposal practices. Primary health care workers also identify and treat common and readily identified diseases and refer patients to health treatment centers.



2 Village screening in Ethiopia.

3 Villagers drawing water from an open well in Malawi.

The principles of prevention of blindness and treatment of common eye diseases – primary eye care – must be incorporated into successful primary health care programs. Primary health care workers can be trained to recognize and manage blinding eye diseases such as cataract, trachoma, and injuries.

Primary eye care includes the following:

- Clinical activities – diagnosis, treatment, or referral of patients with eye disease (2).
- Preventive activities – those that prevent blindness, such as routine instillation of tetracycline into the eyes of newborns by traditional birth attendants to prevent ophthalmia neonatorum.
- Promotive activities – education of community leaders, elders, traditional healers, and citizens in the importance of eye care, surgical treatment, and hygiene (3).



A regular, dependable source of medications and expendable supplies is essential for a successful primary eye care program. Equipment and supplies can be simple, as given below:

- A flashlight (torch) with spare batteries.
- A simplified visual acuity chart.
- Tetracycline 1% eye ointment.
- Vitamin A 200,000 IU capsules.
- Dressings and bandages.

Primary eye care workers require educational support. Their work requires continuous supervision and encouragement by individuals with more comprehensive knowledge and training. Medical assistants, clinical officers, and nurses who have been specially trained in ophthalmology should supervise the primary eye care worker. Training of primary health care workers should include training in basic eye care.

A basic curriculum should include the following:

- Testing visual acuity.
- Referring all patients with visual acuity of less than 6/18 (20/60).
- Training in administration of ocular medications.
- Training in application of dressings to the eye.
- Recognizing and managing eye infections.
- Removal of conjunctival and corneal foreign bodies.
- Recognizing and referring serious injuries.
- Promotion of face washing and improved personal hygiene.
- Recognizing xerophthalmia in regions where vitamin A deficiency is a public health problem.
- Carrying out antibiotic prophylaxis of ophthalmia neonatorum.



4 Village screening by ophthalmic assistant, Malawi.

Health planners can continue to learn from the experiences of new programs in primary health and primary eye care and these experiences and lessons can be helpful in creating effective health programs to improve quality of life. Variations and modifications of these programs are possible. For example, in Malawi, health surveillance assistants from villages – primary health care workers (4) – are mobile on motorbikes (donated by a local Rotary Club) to screen patients at the village level for eye disease and to mass-dose all children under age 6 years with vitamin A capsules for xerophthalmia and tetracycline eye ointment for trachoma. The motorbikes (or bicycles) enable them to reach remote villages to screen and treat children and families who do not have access to a health care delivery point.

## Organization and delivery of eye care

National eye care programs, where they exist in developing countries, function within government health systems, typically the ministry of health. Many such programs receive assistance from international organizations interested in promoting blindness prevention activities (see Appendix G). A national blindness prevention committee within the ministry of health plans and coordinates activities based on the resources available.

In many developing nations, health services are structured in a multitiered system, as given in the following:

- Community level (in nations or areas of nations where primary health care programs are in place).
  - First referral level, usually a health center or district hospital.
  - Second referral level, usually a larger hospital, such as a regional, provincial, or state hospital.
  - Third referral level, usually the central national hospital and teaching center. If a medical school for training physicians exists, it is usually attached to the third (tertiary) level.
- Eye care health workers may be integrated into each level, according to the sophistication of a given country's health services, as follows:
- Community level – a primary health care worker also trained in primary eye care. Referral is to the first level.
  - First referral level – ophthalmic medical assistant, ophthalmic clinical officer, ophthalmic dresser, and all ophthalmic auxiliaries trained to diagnose and treat eye diseases common to the region and to do selected surgical operations. Such an eye care worker functions well in a simple but adequate clinic with basic instruments and equipment and inpatient care facilities. In many African countries, many ophthalmic auxiliaries trained at this level are capable of performing ocular surgery, including extraction of an uncomplicated cataract. Referral is to the second level.
  - Second referral level – an ophthalmologist at the regional, state, or provincial hospital. Such an ophthalmologist supervises all ophthalmic auxiliaries at the first level in the region. An ophthalmologist based at the second referral level also coordinates and supervises the program for the mobile eye unit, regularly visiting rural health stations with the unit, encouraging and teaching ophthalmic medical auxiliaries and assistants, and performing surgery. Ophthalmic auxiliaries also work at this level and diagnose, treat, and manage inpatients and outpatients. Referral is to the third level.
  - Third referral level – the national or central hospital. Here, more sophisticated diagnostic and surgical equipment is available for a wide range of eye surgery. Ophthalmic nurses, ophthalmic auxiliaries, and ophthalmologists staff this health facility. Such a hospital also serves as the training center for ophthalmologists (if attached to a medical school), ophthalmic nurses, and ophthalmic auxiliaries.

Mobile eye units may be based at any level. (For example, motorcycle transport for primary health care workers functions as a 'mobile eye unit' when it delivers primary eye care to communities.) More often, however, mobile eye units are based at the first or second referral level.

The mobile eye unit team may consist of an ophthalmic medical auxiliary, a vehicle driver, and sometimes an assistant (5). The driver may serve as an assistant if a trained assistant is not available. The vehicle is any one appropriate to the environment. A light two-wheel-drive automobile may be sufficient where roads are good; on the other hand, for example in many rural areas where roads may be poorly developed, a durable four-wheel-drive vehicle may be mandatory. The vehicle should not be specially fitted out as an operating theater; such specialized vehicles are expensive and unnecessary. The mobile team visits health facilities in rural areas (6) on a pre-arranged schedule, examines and treats patients, and performs surgery, including intraocular surgery, according to the qualifications of the eye team.



5 Kenya rural eye unit.

A variation of mobile services is that developed by Aravind Hospital in Madurai, India. Here, patients are screened at the village and then surgical candidates are transported to the main surgical center by bus or transportation provided by the hospital. Aravind Hospital systems have been successful in establishing high



6 Mobile eye unit in Kenya in a rural setting.