WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTÉ

WHO/PBL/83.8

Blindness. Prev
Nat. Health prog.

STRATEGIES

FOR

PREVENTION OF BLINDNESS

IN

NATIONAL PROGRAMMES

- A PRIMARY HEALTH CARE APPROACH -

LIST OF CONTENTS

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PREFACE

This document has been jointly prepared by several of the WHO Collaborating Centres for the Prevention of Blindness. It was revised by a working group, convened in November 1981, and further endorsed by the WHO Programme Advisory Group on the Prevention of Blindness at its Fourth Annual Meeting in 1982.

The aim of this document is to facilitate the planning and implementation of national programmes for the prevention of blindness.

The first section of the document gives the general background and information and rationale for blindness prevention as an integral part of primary health care and the development of eye health services. The second section deals with the planning and initiation of national programmes for the prevention of blindness. The third section describes the elements of general eye care at the primary level, and the final section gives the specific strategies for the control of some major blinding disorders in developing countries.

It is hoped that the present document will provide a useful tool for national health administrators and medical professionals to plan and initiate action in the field of prevention of blindness.

Geneva, January 1983

SECTION 1 : INTRODUCTION AND BACKGROUND

CHAPTER 1 : THE CONCEPT OF AVOIDABLE BLINDNESS

Blindness is a major health problem that has received relatively little attention in worldwide efforts to promote health. The vast majority of the world's blind live in developing countries, where infections, malnutrition and lack of eye care give rise to a high proportion of blindness, particularly in rural populations. Thus these countries have blindness rates that are 10 to 40 times greater than those of industrialized countries, where blindness is due mainly to degenerative and metabolic disorders.

It has been estimated that there are at least 28 million blind in the world, if blindness is defined as inability to count fingers at a distance of three metres, which is the definition recommended by WHO (see Table I). There are an estimated 42 million people with severe visual loss, i.e. visual acuity of less than 0.1 (6/60) or the inability to count fingers at 6 metres.

A major portion of the blindness encountered in developing countries can be either cured or prevented by reasonable deployment of skills and resources, and is termed avoidable blindness. Blindness of infectious or nutritional origin can be easily prevented and visual loss from cataract can be restored by simple surgery. Endemic trachoma and associated infections affect approximately 500 million people in the poorer rural communities of developing countries, and can be controlled by mass application of antibiotic ointments in children and corrective lid surgery in adults. Blinding malnutrition due to impaired Vitamin A metabolism can result in permanent blindness by damage to the front of the eye (cornea) particularly in children living in communities with general malnutrition. Cataract or opacity of the crystalline lens of the eye occurs more frequently with advancing age and may affect more than 20% of those over 60 years. It constitutes the major cause of easily curable blindness in most regions, as vision can be restored by simple effective surgery. The parasitic infestation, onchocerciasis, is a major cause of blindness in some African countries, and is present in some foci in Central and South America; its control depends on vector control. Blindness due to ocular trauma can be controlled by preventive efforts at the community level, and by early, appropriate treatment. Glaucoma is a group of diseases characterized by an internal pressure of the eye so elevated that visual impairment occurs. It accounts for about 10% of all blindness. Its control depends on case detection and appropriate surgery or treatment with eye drops.

The general lack of eye health services in underserved communities in developing countries is responsible for much blindness. Early treatment of infectious and nutritional eye disease is essential to prevent visual loss, and such treatment can often be delivered effectively by auxiliary health personnel. The simple guidelines for primary eye care presented in this document should enable any health worker to deal effectively with most of the common eye diseases.

Blindness is an enormous burden to society, and the cost from lost productivity and labour, and from rehabilitation and education of the blind is immense and growing. Swift and effective application of overall resources to prevention of blindness will provide an enormous national saving both in cost and in human suffering. The cost of preventing blindness is only a small fraction of the expense involved in the rehabilitation of the blind, so that the cost-effectiveness of preventive measures against blindness is very advantageous.

The enormity of human suffering attendant upon blindness and the grossly damaged quality of life are reflected ultimately in the reduced life expectancy of the blind in some developing countries.

The objectives of the WHO Programme for the Prevention of Blindness are to make available essential eye care to all populations and to eliminate avoidable blindness. National blindness rates should be reduced to less than 0.5%, with no more than 1% in individual communities. To achieve this, effective national programmes are required, using systematic community-based action to eliminate avoidable loss of vision. Unless rapid and systematic preventive and curative action is taken, the number of blind is likely to double by the year 2000.

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CHAPTER 2 : OVERVIEW

This document describes the necessary components of a national blindness prevention programme effectively integrated into an overall primary health care system. The methods by which an individual country achieves this goal will necessarily depend upon the existing structure of health care delivery and the state of blindness prevention activities. Where an effective vertical blindness prevention activity already exists, such as trachoma or xerophthalmia control, this may be broadened to include activities relevant to the prevention of other blinding conditions. Where such activities are not yet in place, and a primary health structure is being developed, blindness prevention activities should be included as an integral component from the start. Emphasis should be placed on developing activities at the primary village level, as these will benefit the greatest numbers. However, secondary and tertiary facilities also need to be developed to provide continued training and stimulation to the rest of the system, care for more complicated cases and gradually to raise the level of sophistication and competence of the entire programme.

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CHAPTER 3 : GENERAL ASPECTS OF THE PRIMARY HEALTH CARE APPROACH TO PREVENTION OF BLINDNESS

Primary Health Care consists of:

> "... essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination." (Declaration VI, Alma Ata, 1978).

The prevention of blindness must be an integral part of primary health care. There are three distinct closely related components to the primary health care approach, only the last of which requires direct interaction between a sick individual and medical personnel. These include :

(a) Social and community developments that promote health through changes in behaviour and environment and hence lead to the reduction or elimination of factors contributing to ocular disease, e.g. provision of adequate, safe water supplies; growing and consuming foods rich in pro-vitamin A; construction and maintenance of pit-latrines.

(b) Strengthening community cooperation to promote, within the family unit, recognition and appropriate care of individuals at risk of blinding disease, e.g. adequate feeding and oral rehydration of children with severe measles or diarrhoea. Community awareness of eye care at this level can be promoted by local action committees who have a knowledge of local circumstances.

(c) Delivery and utilization of eye care to all individuals with potentially blinding disorders in all communities (e.g. treatment and referral of infectious corneal ulcers by village level workers; cataract surgery performed by mobile teams or at stationary facilities).

Of the three approaches, community and social development may be the hardest to achieve, but will eventually provide the greatest impact. In many areas of the world, blinding infections and malnutrition have practically disappeared, with only moderate socio-economic advance, and despite the absence of specific disease control activities. As these development activities require alterations in cultural practices, they are necessarily difficult to achieve and slow to produce a noticeable effect. Their long-term impact, however, will be considerable, and ultimately produce marked savings for the health care systems.

The provision of medical services to sick individuals has the most obvious and immediate impact, and has, therefore, long received a disproportionate share of available resources and attention. Nonetheless, disadvantaged communities throughout the world suffer from a lack of suitably trained manpower to deal with existing disease. As it is possible and most efficient to deal with most eye diseases in the local communities, where it arises, emphasis should be placed on the development of primary eye care, and a good referral system.

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CHAPTER 4 : THE DEVELOPMENT OF EYE HEALTH SERVICES

Prevention of blindness programmes and the delivery of eye care should be integrated with general health services at all levels. These programmes should be based on available resources and a technology which is appropriate for the country or region. The prevention of blindness requires a flexible approach and the incorporation of regular and adequate training of various categories of personnel. Such programmes should be reviewed on a regular basis, and improvements should be made which are consistent with economic growth and social awareness of the population concerned.

PRIMARY EYE CARE

Primary eye care comprises a simple but comprehensive set of preventive and curative actions, which can be carried out by primary health workers, by specialized auxiliary personnel or by other interested persons. The development and implementation of primary eye care activities will depend on the existing primary health care system. Locally available personnel and training programmes for primary health care should be adapted and used to promote and strengthen the delivery of eye care at the peripheral level. However, in areas without any existing primary health care system, services for primary eye care should be developed, which could eventually evolve into more comprehensive health care activities in the community concerned.

The clinical activities involved in primary eye care consist of three basic ways of dealing with the major eye symptoms presented by patients : inflamed ("red") eyes, loss of vision, and pain in the eye. At the primary level, the health worker can manage these problems either by definitive treatment, by referral after immediate treatment or by referral alone. General guidelines for this action have been developed (see Section IV), but they must be adapted to conditions in the communities served.

In addition, the primary health care worker should carry out promotive and preventive activities, focusing on essential education and community participation with regard to the prevention of visual loss.

Only a few medications and other materials are necessary for primary eye care. At a minimum, an antibiotic eye ointment (usually a tetracycline) is needed, but other drugs that may be useful are Vitamin A capsules, a second antibiotic ointment and zinc sulphate drops

(for mild irritations). Bandages, sticking plaster (tape) and eye shields are very useful for primary workers and optional equipment may include a simple chart to measure visual acuity and a hand torch.

The most important factor necessary to initiate primary eye care is the training of primary health workers to recognize eye conditions and to take appropriate action to deal with the problem. Training manuals for primary health workers should therefore include material on primary eye care. Primary eye care must be supported by reinforcing training and by adequate referral services at the secondary level.

SECONDARY EYE CARE

The eye care facilities available at the secondary level should provide for the definitive management of common blinding conditions such as cataract, trichiasis and entropion (inturned eyelids), ocular trauma, narrow angle glaucoma and corneal and intraocular infections. Secondary eye care activities are usually carried out in dispensaries or in hospitals at the district or provincial level, by staff such as ophthalmic assistants, general practitioners trained in eye care or fully qualified ophthalmologists. This level of eye care should, as much as possible, be integrated into the general medical infrastructure, making the fullest possible use of existing facilities in terms of staff and equipment.

The secondary eye care centres play an important role as the referral level for patients that cannot be managed at the primary level. A close liaison between such a centre and the local health workers, is, therefore, essential, and the staff of the secondary level must be actively involved in the training and supervision of local health personnel working in the field of eye care.

The management of less common blinding conditions, which may require sophisticated equipment and specialized staff, should normally not be carried out at the secondary level of eye care. The resources needed for such conditions, e.g. corneal grafting, retinal detachment surgery, etc., are usually more efficiently utilized in regional or national centres providing tertiary eye care.

TERTIARY EYE CARE

Facilities to provide sophisticated eye care are often available in university hospitals or similar institutions. The eye care delivered at this level usually covers a variety of diagnostic and therapeutic services, but the availability of these is often limited to urban populations. It is important that the staff of tertiary eye centres are involved in the training of various categories of health personnel in eye care, and that support to the work at the primary and secondary levels is given. The tertiary eye units should also provide technical leadership, and play a leading role in the promotion of various aspects of public health ophthalmology, including research related to the delivery of eye care.

Support should also be given concerning the regular restocking of ophthalmic drugs and supplies, and in the assessment of locally prevalent disorders, e.g. trachoma.

MOBILE EYE SERVICES

Mobile ophthalmic teams may fulfil the function of delivering primary and secondary eye care in areas where such services are lacking. The mobile units may also give valuable support to existing eye care services, particularly in the epidemiological and clinical assessment of specific blinding disorders. Mobile eye camps have successfully been used in certain countries to provide cataract relief services at the peripheral level. These surgical teams can also perform optical iridectomies, a simple procedure that restores useful vision to some individuals with central corneal opacities.

Mobile eye services may allow for efficient interventions against blinding diseases in certain areas. However, it is important to ensure the continuity and follow-up of activities initiated by such mobile teams, and to have a close collaboration with the local health personnel and the communities concerned, e.g. initiating health education activities.

These services can however be of temporary nature and must eventually be replaced by a permanent infrastructure of eye health care.

SECTION II : NATIONAL PROGRAMMES FOR THE PREVENTION OF BLINDNESS

INTRODUCTION

National programmes for the prevention of blindness need a central organization to determine priorities, mobilize and allocate resources, provide support at all levels of eye care, organize training and health education and evaluate programme activities. The goal of national programmes should be the control of avoidable blindness. Blindness prevention programmes may evolve from programmes designed to control specific diseases (e.g. trachoma) or may be established because excessive rates of blindness have been recognized.

National programmes must be based on the human and financial resources available in the country as well as those potentially available to meet the goals of the national programme. Blindness prevention must be firmly based in primary health care but it necessitates the provision of definitive (or secondary) care, especially treatment of acute blinding conditions (e.g. corneal ulcers) and for the surgical cure of cataract. Governmental policies must foster not only the training of ophthalmic personnel, but also their retention and equitable geographic distribution in the country and the fullest possible utilization of their resources.

The delivery of essential eye health services at the peripheral level should be an integral component of primary health care, which includes the promotion of eye health as well as the prevention and treatment of blinding conditions.

National programmes, with the objective of reducing avoidable blindness, must organize and coordinate activities at all levels. These actions include:

(1) Assessment surveys to identify communities with a high prevalence of avoidable blindness and to determine the causes of this blindness.

(2) Formulation of objectives and development of appropriate intervention strategies.

(3) Training of personnel to take effective roles at all levels in the programme.

(4) Development and provision of support for primary eye care.

(5) Promotion and organization of individual and community participation in blindness prevention activities through health education.

(6) Maintenance and monitoring of activities at the secondary and tertiary levels to ensure that they fit the needs of the programme.

(7) Organization of special intervention activities to reduce excessive blindness caused by specific problems.

(8) Evaluation of the impact of the programme on blindness and blinding diseases.

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CHAPTER 1 : PLANNING

National programmes should provide a framework which allows the greatest possible initiative and innovation by health workers at all levels, particularly in primary eye care. In some instances, independently organized and administered units (e.g. voluntary eye hospitals) can offer vital services and should be encouraged if they contribute to the national goals of blindness prevention.

Those essential features of the national programmes which must be organized and administered at the national level (or provincial level in large countries) include:

(1) Establishment of a National Committee or other authority to promote, initiate and coordinate blindness prevention activities.

(2) Statement of a national policy for prevention of blindness.

(3) Establishment of a central agency or bureau to carry out prevention of blindness policies.

(4) Identification of manpower, facilities and programmes already active in prevention of blindness.

(5) Assessment of blindness and blinding conditions:

  (a) Collection and review of existing information;
  (b) Assessment surveys.

(6) Formulation of a broad plan of action and specific strategies with task identification and task analysis.

(7) Implementation of primary eye care.

(8) Strengthening of secondary and tertiary health facilities to support primary eye care.

(9) As a temporary measure utilization of mobile units (when applicable) and organization of other outreach activities related to prevention of blindness.

(10) Plans to deal with technical aspects of managing the major blinding disorders in the country.

(11) Training and continuing education of personnel in activities related to prevention of blindness:

  (a) Primary health care workers;
  (b) Specialized ophthalmic auxiliary staff;
  (c) General physicians;
  (d) Ophthalmologists, including sub-specialities.

(12) Supervision, motivation and evaluation of personnel at all levels, including provision of appropriate career structures.

(13) Promotion of community participation and health education.

(14) Provision of logistic support:

  (a) Salary and necessary expenses for personnel.
  (b) Equipment, supplies and transport.
  (c) Use of local industries and appropriate technology, e.g. low-cost spectacles and diagnostic equipment.

(15) Mobilization of financial and other resource inputs:

(a) National inputs from Government and private funds or donations;
(b) Intergovernmental agencies;
(c) Nongovernmental organizations;
(d) International agencies.

(16) Evaluation of implementation:

(a) Measurements of programme activities in terms of time, cost and performance;
(b) Effect on blindness rates and on the prevalence of specific disorders.
(c) Assessment of other useful indicators, such as development of eye health services, community participation, and changes in social and economic factors related to visual disability and its prevention.

CHAPTER 2 : MOBILIZATION OF RESOURCES

NATIONAL RESOURCES

Most national programmes must directly involve existing health services which are already carrying out eye care in the country. The identification of both governmental and nongovernmental resources for eye care is an important initial step in programme development. The identification of available resources and an assessment of current needs are critical steps in mobilizing resources at the national level.

With an inventory of present efforts and a carefully prepared plan of action, strong arguments can be made to increase resources available for prevention of blindness. External resources and assistance may more easily be generated after a firm national commitment has been established. The specific ways in which this external support would strengthen the programme should be described in detail.

It is necessary to increase public awareness of blindness and how it can be avoided, to establish a consensus on the need for a national blindness prevention programme. This awareness can be generated by individual opinion makers and through the press, television and other media. Once a favourable climate of opinion has been generated it is easier for government to allocate further resources to prevention of blindness.

Nongovernmental resources, voluntary agencies and others may be making a substantial contribution to blindness prevention through subsidized hospitals and clinics. Although these voluntary efforts do not have to be modified, their contribution to the national plan should be recognized. Every effort should be made to obtain support from the non-governmental sector whether in the form of financial contributions, volunteer personnel, donations of supplies and materials, or of facilities.

INTERNATIONAL COOPERATION

WHO, through its Programme on Prevention of Blindness can, upon request, offer assistance to national programmes in the organizing phase and in specific aspects of prevention of blindness activities. Other United Nations (UN) and international agencies, such as the United Nations Children's Fund (UNICEF) and the World Bank, can also make valuable contributions to the specific aspects of the development process that will reduce the level of avoidable blindness.

There are a number of international nongovernmental organizations that are active in blindness prevention, and these may be particularly able to supply temporary technical staff or provide supplies and equipment.

Bilateral programmes between governments usually involves the transfer of financial resources. These bilateral arrangements may create a greater responsibility between the two countries involved, which can be a source of support for the blindness programme.

Technical cooperation among developing countries (TCDC) provides an efficient mechanism for promoting prevention of blindness. Regional and subregional collaboration should be encouraged in specific fields, such as training of personnel and organization of disease control programmes.

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CHAPTER 3 : INITIATION OF NATIONAL PROGRAMMES FOR THE PREVENTION OF BLINDNESS

Once a national plan for the prevention of blindness has been formulated in a country, steps should be taken to ensure a rapid implementation. During the early phase the programme will have to rely on available resources within the country, which necessitates optimal utilization of those resources.

The following measures should be considered in the initial phase of implementation :

(1) The medical and administrative staff, who will be responsible for the management of the blindness prevention programme at the central as well as peripheral levels should be designated and briefed about their new responsibilities. It is of particular importance to identify responsible health administrators at the provincial, district and local community levels, in accordance with the local administrative divisions. The medical administrators should, after having received appropriate information and training, consider resources for blindness prevention within the existing local infrastructure, and ensure the integration of any new activities with ongoing routines. Short national workshops or seminars for the local medical officers and administrators who will be involved in the management of the prevention of blindness activities have proved to be a useful and efficient means of imparting the necessary information and training to that effect.

(2) The establishment of one or several national teams for blindness surveillance. These teams should collect and analyse essential data on blindness. They can be small and include auxiliary personnel. During field surveys these surveillance teams should collaborate with and utilize local health personnel.

(3) The training of auxiliary health personnel in eye care should begin in the initial phase of a national blindness prevention programme, even if there is a limited availability of equipment or of teaching staff. Much valuable experience can be gained in trial courses for a few pupils, which will considerably facilitate the planning and allocation of resources for training on a large scale. Training activities in eye care for personnel at the primary and intermediate levels, will then have been elaborated in the planning phase of the programme, and should be implemented when appropriate. A detailed inventory of available and possible training facilities at various levels should be made, and utilized accordingly. The future needs in terms of manpower, (i.e. teaching staff) and training aids, documentation and teaching equipment, should be clearly identified and listed, to facilitate the mobilization of internal and external resources for this purpose. It is of particular importance to initiate the training of village health workers in eye care at an early stage of the programme, to ensure the full participation and active involvement of local communities in the national programme.

(4) A detailed inventory of available dispensaries, health centres, eye clinics and other institutions suitable for the delivery of eye care at the primary, secondary and tertiary levels should be made. The existing infrastructure for eye health services should accordingly be clearly defined for each local administrative division. The resources needed, in terms of manpower, equipment and supplies, to strengthen this network and to establish an adequate referral system should be analysed and presented in a form suitable for funding requests.

(5) A reliable system for the regular supply of drugs and other ophthalmic supplies as needed, should be worked out for the various levels of eye care delivery. This can often be included in the general medical supply system, but particular attention must be paid to remote rural areas in this context, where the shortage of local health personnel may necessitate improvised systems. The consumption and utilization of ophthalmic supplies should be periodically checked by supervisory staff.

(6) The participation of the community should be ensured from the initial stages of the programme for its acceptability by the people. The potential risks of some indigenous health practices and taboos need to be highlighted and gradually overcome by a sustained health education activity.

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SECTION III : PRIMARY EYE CARE

This chapter closely follows the report of a Task Force on Primary Eye Care, held in WHO Headquarters, Geneva, from 20 to 23 October 1980, and adopted by the WHO Programme Advisory Group on the Prevention of Blindness at its Third Annual Meeting in 1981.

CHAPTER 1 : DEFINITIONS OF PRIMARY EYE CARE

Primary eye care is a vital component of primary health care and includes the promotion of eye health and the prevention and treatment of conditions that may lead to visual loss.

Primary eye care implies the first provision of promotive, preventive and therapeutic measures for eye health to an individual or a community. Such measures may be provided at different levels of sophistication depending on local conditions and resources. However, primary eye care should be an integral part of primary health care, in view of the existing situation in most developing countries, where avoidable blindness constitutes a major public health problem. In this context, priority should be given to the determination of the essential eye care that needs to be delivered at the most peripheral level. The implementation of primary eye care must also be adapted as far as possible to locally available personnel and existing training programmes. In areas without any primary health care system, primary eye care services should be developed, and could eventually evolve into a primary health care system.

Primary eye care needs to be sustained and supported by an adequate referral system. This implies the conducting of regular short training courses and the participation of primary health workers in activities such as those of surgical mobile teams.

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CHAPTER 2 : PRIMARY EYE CARE ACTIVITIES

Primary eye care can be divided into (1) Clinical, and (2) Promotive and Preventive activities. With regard to clinical activities, distinction should be made between conditions that ought to be:

(A) Recognized and treated by the primary health care worker.

(B) Recognized and referred after treatment has been initiated.

(C) Recognized and referred for treatment.

CLINICAL ACTIVITIES

(A) CONDITIONS TO BE RECOGNIZED AND TREATED BY A TRAINED PRIMARY HEALTH CARE WORKER

1. Conjunctivitis and lid infections

(a) Acute conjunctivitis is recognized by redness of the globe and palpebral conjunctiva and purulent discharge without any loss of vision. This should be treated with frequent applications of antibiotic drops or ointment by the patient or a family member. If there is no improvement in three days, the patient should be referred.

(b) Ophthalmia neonatorum : A red eye with lid swelling and discharge, occurring in the first few days after birth, is often caused by gonococcal infection. Conjunctivitis in the newborn is a serious and potentially blinding disorder, which requires immediate and intensive topical and systemic antibiotic treatment.

Treatment should be carried out immediately with topical 1% tetracycline ointment 4 to 6 times daily and systemic antibiotic treatment. It may be necessary to continue the treatment for 2 weeks or longer until the conjunctivitis disappears. Cleaning of the eyes should be done frequently to keep them free of discharge.

To prevent ophthalmia neonatorum all newborn infants must be treated immediately after delivery with a single application of tetracycline 1% eye ointment or with silver nitrate 1% drops in both eyes (Credé's prophylaxis). Birth attendants and midwives should be instructed how to apply this prophylaxis to the eyes of every newborn.

(c) Trachoma : Trachoma is a chronic, endemic conjunctivitis often associated with seasonal epidemics of purulent conjunctivitis. If the disease is endemic, the areas in which mass treatment is required should be determined. The treatment consists of the application twice daily of tetracycline 1% ointment to all children for five consecutive days each month for six months each year. Primary health workers should participate in these treatment programmes and learn to recognize active trachoma and the resultant inturned eyelashes (trichiasis/entropion). Further recommendations for trachoma control are given in Section IV, Chapter 1.

(d) Allergic and irritative conjunctivitis : These include most of the minor affections producing chronic redness and itching without discharge or visual loss, and includes blepharitis (lid margin infection), allergic conditions and irritation from dust. These conditions are treated with zinc sulfate drops for short periods. Corticosteroid preparations should never be used in field conditions by auxiliary personnel, or without proper supervision, for the treatment of conjunctivitis or other inflammation of the eye.

(e) Lid lesions : Lid inflammation includes styes (acute abcesses) and chalazia (chronic fatty cysts). These should be treated by the application of warm compresses or warmth to the eye, and by the application of antibiotic ointment for 3 days.

2. Trauma

(a) Subconjunctival haemorrhages appear suddenly as a bright red patch on the white of the eye without discharge or visual loss or pain. The condition does not require treatment, but the patient should be reassured that this is not serious and heals rapidly. Subconjunctival haemorrhage associated with pain or visual loss should be referred.

(b) Superficial foreign bodies

- Conjunctival : Foreign bodies under the eyelids, especially the upper eyelid, should be investigated by proper eversion of the lids. These foreign bodies can be removed with twisted cotton wool or a clean piece of cloth, following which antibiotic ointment should be applied.

- Corneal : Foreign bodies in the cornea usually produce redness, pain and tears. They may be detected by the naked eye but a magnifying loupe or magnifying glass is useful to identify and localize them. They may also be detected by irregularities in the surface reflection of a window or door on the cornea. Gentle scraping with a small blunt instrument, a folded piece of paper or a cotton tipped applicator may be used to remove superficial corneal foreign bodies. After removal, antibiotic ointment should be applied. If the foreign body cannot be removed easily, the case should be referred to the secondary level.

(c) Corneal abrasions are due to the loss of the superficial layer of cells on the surface of the cornea, usually following a minor injury to the eye, e.g. a fingernail scratch. Corneal abrasions can be detected by the presence of an irregular surface reflection on an otherwise clean cornea. Corneal erosions are treated by the application of an antibiotic ointment and the application of a sterile eye patch, if available. The antibiotic application is repeated daily as long as the eye is painful.

(d) Blunt trauma (contusions)

- Ecchymosis of the lids ("black" or bruised eyelids) do not need treatment if vision has not been affected.

- Blood behind the cornea (hyphaema) has the appearance of a dark red stain of the cornea (often with a fluid level) that hides the pupil and iris. These patients usually have some visual loss. These cases should rest for five days. They must not be given aspirin or aspirin derivatives (any salicyclic acid derivatives). If there is severe pain or nausea and vomiting, or if the blood does not disappear, at least in part, within five days, the case should be referred to an ophthalmic centre.

3. Blinding Malnutrition

Blinding malnutrition (xerophthalmia and keratomalacia) usually occurs in children under six years with malnutrition. Vitamin A deficiency can present as:

- night blindness (for instance, a child who cannot see or find its mother in a darkened room);

- foamy spots on the white of the eyeball on either side of the cornea (Bitot's spots);

- dry eye, in which the cornea appears to be roughened and dull and does not have moist appearance (xerophthalmia);

- corneal ulcers may occur in severely malnourished children, particularly after measles. In these cases the child may not complain of pain and a black spot may appear on the surface of the cornea where the iris has been pushed through.

These cases should all be treated with 110mg (200 000 I.U.) of retinol palmitate (Vitamin A) orally on two successive days. All children with corneal ulcers should receive Vitamin A whether or not a deficiency is suspected (and referred as indicated below). Further recommendations for the control of blinding malnutrition are given in Section IV, Chapter 2.

(B) CONDITIONS THAT SHOULD BE RECOGNIZED AND REFERRED AFTER TREATMENT HAS BEEN INITIATED

It is assumed that secondary or tertiary level centres are available for referral. However, in some areas, access to such centres may be limited, difficult or delayed; under such circumstances the initial treatment given should be continued.

1. Corneal ulcers

Corneal ulcers can be recognized as red, painful eyes usually with some decreased vision, and frequently cause blindness. The surface reflection of the cornea is irregular and there is often a white spot on the cornea. These potentially blinding conditions require urgent and expert attention. It is important that the primary health care worker should recognize the condition, initiate treatment by cleansing and by topical application of antibiotics; the patient should then be immediately referred to a secondary level centre.

2. Lacerations or perforating injuries of the eyeball

These injuries are caused by trauma to the eye. The eye is usually red and painful with visual loss. There is often a black spot protruding through the wound (the iris or uvea). The eye should be protected with a shield and systemic antibiotic treatment administered if available. Eye ointment should be avoided.

3. Lid lacerations

Large lid lacerations and those involving the lid margin should be referred, after initial gentle cleansing and padding. Systemic antibiotics may be administered, if available, before referral.

4. Entropion/Trichiasis

Inturned eyelids with eyelashes rubbing on the cornea (trichiasis and entropion) are most common in regions with blinding trachoma, but may occur for other reasons. The patient usually complains of a scratching of the eye. The inturned eyelashes can be detected with a good light directed at the lid margin, and the lids slightly rolled away from the eye while the patient looks up and then down.

These cases must have eyelid surgery as soon as it is convenient. If the locality is visited regularly by a trachoma surgery team, a list of such patients should be kept for the team. Otherwise the patient should be referred to the nearest eye service for surgery. As a temporary measure to prevent damage to the cornea and relieve symptoms, the inturned eyelashes should be pulled out with epilation forceps, and antibiotic ointment should be applied at least once daily until surgery can be done.

5. Burns

- Chemical: Prolonged irrigation with the eyelids held wide open should be carried out immediately, and antibiotic ointment, if available, applied before referral.

- Thermal: If there is serious skin damage, antibiotic ointment should be applied and the patient referred.

(C) CONDITIONS THAT SHOULD BE RECOGNIZED AND REFERRED FOR TREATMENT

1. Painful red eye with visual loss

These patients should be referred immediately.

2. Cataract

Cataract is an opacity of the lens of the eye. Patients with cataract have gradual loss of vision not accompanied by pain. In advanced cases the pupil appears to be chalky white or greenish-grey in colour. These patients should be referred as is convenient to the nearest eye service for surgery to restore sight. Further recommendations for the management of cataract are given in Section IV, Chapter 4.

3. Pterygium

Pterygium is a red, fleshy growth on the surface of the eye that comes onto the surface of the cornea and may eventually obscure vision. If the vision is affected, the patient should be referred to the nearest eye service as is convenient.

4. Visual loss

Patients whose vision has decreased and with a vision worse than 0.3 (6/18) in either eye should be referred.

PROMOTIVE AND PREVENTIVE ACTIVITIES

In order to promote eye health and prevent loss of sight, the primary health care worker should disseminate appropriate information to as many people in his community as possible. Much of this education could be imparted to specific target groups, such as village leaders, community councils, administrative authorities, school teachers and pupils, as well as individual households.

The primary health care worker must be an effective educator, capable of making the community aware that the majority of blinding diseases are either preventable or curable. He should also educate on personal and environmental hygiene, nutrition, sanitation, and protection of the eye.

The primary health care worker should stimulate individual and community participation in activities to prevent blindness, and become actively involved in community-based treatment programmes, for example against trachoma and xerophthalmia. The primary health care worker should also alert and follow up local activities initiated by higher levels of eye care services or mobile units. Such activities may include the supervision of treatment schemes and reassessment of certain results, e.g. trichiasis operations.

* * *

CHAPTER 3 : PERSONNEL AND TRAINING

Primary health care workers should be responsible for the delivery of primary eye care, and this should be an integral component of their duties.

MINIMUM QUALIFICATIONS FOR SELECTION

(a) Ability to read and write
(b) Acceptable to, and preferably selected by, the community.

TRAINING

Training should be simple, practical and task-oriented. It should be carried out, as far as possible, in or close to the community to be served and should preferably be imparted by the supervisor, who would also be responsible for evaluation. Wherever feasible, existing health facilities may be utilized for group training.

SUPERVISION

The primary health care worker should be supervised through regular visits of the secondary level personnel, e.g. ophthalmologist, ophthalmic medical assistant, general physician or other competent health personnel.

RECORDS AND REPORTING

Records should preferably be kept in a notebook indicating the following details: name, age, sex, tribe (where applicable), locality, complaint/symptoms, provisional diagnosis, and the treatment given.

Reporting should be done by the supervisor during visits to the primary health care worker, extracting relevant information from the record book.

REFRESHER COURSES

These should be provided periodically by the supervisor or other suitable personnel, either at the community level, or, if possible, at a training centre.

EVALUATION OF TRAINING

Evaluation of the training and the performance of the primary health care worker should be carried out by the supervisor, utilizing the record book and personally assessing the field work.

An overall evaluation of the prevalence of the blinding conditions in the community concerned and the effectiveness of the role played by the primary health care worker should be the responsibility of suitably qualified personnel.

CHAPTER 4 : SUPPLIES AND EQUIPMENT FOR PRIMARY EYE CARE

In many areas, local conditions should guide the choice of drugs and equipment from the following lists :

DRUGS

- Tetracycline 1% eye ointment
- Chloramphenicol or another antimicrobial preparation for topical use in the eye
- Zinc sulphate 0.2% eye drops
- Vitamin A capsules - 110mg retinol palmitate (200 000 I.U.)
- Silver nitrate 1% eye drops - for use in the newborn as a prophylactic. Alternatively, a single application of tetracycline 1% eye ointment can be given to prevent ophthalmia neonatorum.

EQUIPMENT AND SUPPLIES

- Optotypes. These should be adapted to local needs and could include:- Landolt ring; Snellen chart; E Types; Sjögren's Hand Chart; either as single optotypes or a simplified multiple optotype chart.
- Torch and batteries.
- Hand magnifying lens.
- Epilation forceps in trachoma endemic areas.
- Dressings:- eye pads, bandages, sticking plaster, eye shields.

Wherever feasible, local production of items, such as bandages, shields and epilation forceps, should be encouraged.

Eyedrops and ointments containing pilocarpine, atropine or corticosteroids should not be provided at the primary level.

It is highly desirable that the supply of ophthalmic drugs to the primary health care centres be as standardized and as uniform as possible, in order to enhance availability and reduce costs.

To avoid the loss of supplies and drugs, it is recommended that there should be regular supervision and auditing, which would also ensure the adequate and regular supply of medicaments.

CHAPTER 5 : TRAINING AIDS

The training of a primary health care worker in the field of eye care will require teaching aids, such as manuals, recognition cards and posters. Such aids should be simple, of durable material and obtainable at a relatively low cost.

Primary eye care is an essential part of primary health care and the importance of promoting eye health at the community level should be stressed. Training aids could include material on:

(a) Methods of Examination (to be illustrated by diagrams and/or photographs)

- Taking and assessing the patient's history.
- Assessment of visual acuity and recording.
- Inspection of the eye and the lids.
- Exposure of the conjunctiva of the lower lid.
- Eversion of the conjunctiva of the upper lid.
- Inspection of the globe in different directions of gaze.
- Examination of infants.

(b) Clinical conditions

The manual should outline the conditions to be recognized and treated by the primary health care worker and those needing referral, as listed above.

Suitable illustrations, together with brief and clear descriptions, should be used.

(c) Methods of treatment

- Cleaning and irrigating the eye.
- Applying eye drops and ointment.
- Application of eye pads, shields and strapping and bandaging.

(d) Community participation in the prevention of blindness

The preventive and promotive aspects of blindness prevention should be included.

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SECTION IV : METHODOLOGICAL APPROACHES TO SPECIFIC BLINDING PROBLEMS

INTRODUCTION

In some communities with heavy loads of preventable blindness, there may be a need for intensive control programmes directed against one or more specific eye diseases. Methods for the control of blinding trachoma, nutritional blindness and ocular onchocerciasis are described in WHO publications listed in the Bibliography. Of the other conditions that contribute to blindness in almost all countries, cataract is by far the major blinding condition and may involve over 90% of those over 60 years of age.

The features of these disorders and the means to control them are presented here to give a broad overview of these major blinding diseases. The specific WHO publications prepared for some of these conditions present the control measures more fully.

Another particularly useful document for national programmes for the prevention of blindness is "Methods of Assessment of Avoidable Blindness" (WHO Offset Publication No.54) which describes in detail practical techniques needed for the assessment of blindness and blinding conditions by surveys. These assessment techniques are not summarized here, but should be reviewed directly from that publication.

* * *

CHAPTER 1 : TRACHOMA

1.1 PRESENT STATE OF KNOWLEDGE

Endemic trachoma is still a major cause of blindness in rural communities of the developing world. Trachoma and associated infections are estimated to affect approximately 500 million people, most of them in poorer rural communities of the developing world especially in the arid areas. There are probably 6 to 9 million blind from trachoma, and a much larger number has suffered partial loss of vision. Trachoma can be controlled and blindness and visual loss prevented by relatively simple and inexpensive measures.

DESCRIPTION

Trachoma is a chronic inflammation of the eye leading to red, rough, thickened membranes covering the inside of the eyelid and to opacity of the cornea. The specific etiologic agent of trachoma is Chlamydia trachomatis, but other pathogenic microorganisms often contribute to the disease process.

In various communities trachomatous inflammation may undergo spontaneous resolution, or may progress to conjunctival scarring which can cause inward deviation of eyelashes (trichiasis) or of the lid margin (entropion). The abrasion of the cornea by wiry lashes, and defects in lid closure, frequently result in corneal ulceration, followed by scarring and visual loss. Thus trachoma may heal with no permanent damage or it may, in its severest form, lead to gross and crippling damage to the cornea. The final visual acuity may range from normal vision to total blindness. There is now a clearer definition of the risk for the individual and for the community which makes it practicable to distinguish communities with "blinding trachoma" from those with "non-blinding trachoma".

ETIOLOGY

Chlamydia trachomatis eye infections occur in two distinct epidemiological situations, each carrying different significance for the affected communities. The first is the classical potentially blinding disease of developing countries that is spread by eye-to-eye transmission of infection, and is best defined as hyperendemic (or endemic) trachoma. It is caused by C. trachomatis, almost invariably the serotypes A, B, or C.

Infection of the eye by sexually transmitted C. trachomatis (serotypes D, E, F, G, H, I, J, or K) produces an eye disease which is often not distinguishable from the inflammatory phase of endemic trachoma. Milder cases of this eye disease are usually called inclusion conjunctivitis, but the term "paratrachoma" conveniently applies to the whole spectrum of disease resulting from eye infections with sexually transmitted chlamydiae. These sexually transmitted C. trachomatis also infect newborns and cause conjunctivitis, pneumonia and gastrointestinal infection. Although the sporadic eye infections with these C. trachomatis strains rarely produce permanent visual loss, the respiratory tract infections in infants and genital tract infections in adults are important health problems in affected populations.

Pathways to blindness in communities with endemic trachoma: communities with trachoma of blinding severity usually suffer from annual or biennial epidemics of bacterial conjunctivitis. These seasonal epidemics are clearly associated with vastly increased numbers of eye-seeking flies. This combination of factors escalates nonblinding trachoma into blinding trachoma in the community concerned. Furthermore, during these seasonal epidemics, suppurative corneal ulceration is common, and constitutes an acute pathway to bilateral blindness. This "acute ophthalmia" adds to the chronic trachomatous ("chronic ophthalmia") pathway to blindness.

EPIDEMIOLOGY

Trachoma has a worldwide distribution. At present, blinding trachoma is a major public health problem in parts of Africa, the Middle East and the drier regions of the Indian subcontinent and South East Asia. Pockets of blinding trachoma exist in Latin America, Australasia and the Pacific Islands. Non-blinding trachoma is present in these same areas as well as in a much broader region that includes most of the drier subtropical and tropical countries.

In Europe and North America, trachoma regressed and disappeared with the rising living standards that accompanied industrialization and economic development. Thus under the living conditions prevailing in developed countries and in better off urban communities of developing countries, trachoma is rarely transmitted and, if acquired, it is mild.

In the most heavily affected communities, most children are infected by the age of 1 or 2 years and by adolescence the prevalence of active disease starts to decline, but some adults continue to have signs of active disease. Because children constitute such a large proportion of the population in hyperendemic trachoma areas, those with active disease are the chief reservoir of trachomatous infection in the community.

Blinding lesions are the outcome of earlier severe or moderate intensity inflammatory disease. These are generally observed in adults but may occur in childhood due to very severe inflammatory disease.

It has long been known that trachoma is associated with poverty and that economic development appears to eliminate or reduce the severity and prevalence of the disease. Among the environmental and behavioural features of greatest importance are the presence of young children in the household, crowding, and the unavailability of safe water for household use. All these factors, together with inadequate disposal of human and animal waste, contribute to an increase in the fly population, and to the frequent, unrestricted, and indiscriminate mixing of ocular contacts or of ocular discharges.

DIAGNOSIS

The upper tarsal conjunctiva has been selected as a convenient index of trachomatous inflammation in the eye as a whole. A classification of the intensity of inflammatory disease in individual cases has been developed that is based on the scoring of the specific signs, lymphoid follicles (F) and papillary hypertrophy (P), which are described in the WHO publication "Guide to Trachoma Control" (see References and Bibliography).

A community with blinding trachoma can be recognized by the presence of persons with severe visual loss due to corneal opacity and a substantial prevalence of potentially disabling trachomatous lesions, particularly trichiasis/entropion. These irreversible changes appear as the long term outcome of prolonged or recurrent inflammatory disease of moderate or severe intensity. Communities with non-blinding trachoma have a low prevalence of potentially blinding lesions, and they do not have a substantial prevalence of visual loss due to trachoma.

In communities with trachoma, chlamydial infection is always present, but other ocular microbial pathogens appear to contribute significantly to the intensity of trachoma and to the lesions that impair vision.

1.2 METHODS OF INTERVENTION

CHEMOTHERAPY

In communities with severe blinding hyperendemic trachoma the objectives of chemotherapy are:

(a) Reduction in the intensity of trachoma, and hence of the incidence of blindness.

(b) Reduction in transmission of infection.

Sulfonamides, tetracyclines, erythromycin, certain other macrolides, and rifampicin are known to be effective in treating active trachoma. Topical tetracyclines (eye ointments or suspensions) are the recommended preparations for large scale treatment of trachoma.

Trachoma control programmes have been based essentially on the mass application of locally applied antibiotics. Initial intensive large scale chemotherapy should reduce the ocular reservoir of Chlamydia in the population and should be followed by intermittent, family-based topical treatment to control further eye-to-eye transmission. Such family-based treatment with topically applied antibiotics depends on the easy local availability of effective drug preparations at low cost, and on vigorous health education by local health workers.

There may be a rationale for the use of systemic chemotherapy on a selective basis.

SURGICAL CORRECTION OF TRICHIASIS AND/OR ENTROPION

The correction of lid deformities has an immediate impact on preventing blindness. These simple procedures can be carried out in affected communities. Surgical programmes may still be required where active trachoma is no longer a problem but where the previously acquired trachomatous scarring among older age groups continues to evolve and to cause new lid deformities and visual loss.

1.3 ACTION AT VARIOUS LEVELS

PRIMARY LEVEL

The actual application of antibiotics to the eye is often carried out by local health aides with little, if any, formal training in health work.

In the long run, most of the antibiotic treatment must be carried out by the affected population itself. To do this, the people need to have an understanding of the disease and measures that can be taken for treatment. Provision of water, reduction of household crowding, identification and control of breeding sites of eye-seeking flies and improvement of personal hygiene should be actively encouraged and assisted, in order to reduce the transmission of eye infections.

SECONDARY LEVEL

Simple eyelid surgery in the community itself is essential to block the chronic pathway to blindness from trachoma. This surgery can be provided either by health centres or mobile teams. Experience has shown that selected and appropriately trained medical auxiliaries can provide most of the lid surgery needed.

Once the backlog of trichiasis and entropion has been dealt with, there will be a continuing need for surgery on a lesser scale because cases of potentially blinding lid distortions will continue to arise long after infective stages of trachoma have been controlled in the community. In severely affected communities periodic surveillance with provision of lid surgery will therefore be required for many years.

1.4 ORGANIZATIONAL ASPECTS OF TRACHOMA CONTROL

PLANNING AND INTEGRATION

The primary objective of public health programmes for the control of trachoma is the prevention of blindness. Such programmes should be designed and implemented as an integral part of activities aimed at controlling blindness from other major causes. Once control of blinding trachoma has been achieved, provision must be made to maintain surveillance to detect the occurrence of cases with severe, potentially blinding trachoma.

Control programmes should be focused on communities with a substantial prevalence of blinding trachoma as indicated by the presence of:

(a) corneal blindness, with

(b) potentially blinding trachomatous trichiasis and entropion;

(c) moderate and severe trachomatous inflammation.

Preliminary prevalence surveys should identify communities with blinding trachoma which can be recognized by the presence of persons with severe visual loss due to corneal opacity, a high prevalence of severe and moderate intensity of inflammatory disease and trichiasis and entropion. Such surveys should also assess blindness rates and other causes of blindness in the community.

Programmes to control trachoma should include the following elements:

(1) Assessment of the problem.

(2) Allocation of resources.

(3) Training and utilization of local health workers.

(4) Chemotherapeutic interventions.

(5) Surgical interventions to correct lid deformities.

(6) Health education and community participation.

(7) Evaluation of the effect of intervention.

TRAINING

Effective control of blinding trachoma can be achieved by the introduction of relatively simple measures which can be applied by appropriately trained health personnel, including auxiliaries. Training is therefore an essential part of trachoma control measures.

Because conditions vary in different countries, or within different regions of the same country, it is not possible to provide detailed recommendations for training that would be valid everywhere. It is possible, however, to define tasks in a progressive scale of complexity and to list broad categories of personnel who would be involved in their implementation.

The tasks to be performed in trachoma control programmes include:

(1) Organization and administration.

(2) Special disease control activities:-

- Identification of disease and recording findings;

- Treatment.

(3) Promotion of eye health.

EVALUATION

The selection of target populations is a critical step in trachoma control programmes. Follow-up assessments are necessary to evaluate the effectiveness of the programme. The needs of each community change continuously and must be reviewed at regular intervals. Antibiotic treatment and economic development may substantially and rapidly reduce the prevalence of the inflammatory disease. On the other hand, in communities with a substantial amount of potentially disabling scarring, new cases of trichiasis/entropion will continue to appear, so continuing surveillance will be necessary for many years after active inflammatory trachoma has been controlled.

1.5 RECOMMENDATIONS FOR COMMUNITY-BASED TRACHOMA CONTROL

Community-oriented treatment of trachoma should aim at decreasing the intensity of the disease and reducing the reservoir of the infection especially in children. The identification and surgical correction of deformed eye lids are essential components in programmes to prevent blindness due to trachoma.

COMMUNITY AND SOCIAL DEVELOPMENT

The provision of water for domestic use, reduction at household crowding, elimination of the breeding sites of eye seeking flies and improved personal hygiene all have an effect on reducing the intensity of inflammation in trachoma. Health education is an essential tool to achieve these behavioural changes.

ANTIMICROBIAL THERAPY

The mass application of a topical antibiotic (usually a tetracycline) may be supplemented by oral antibiotics. Detailed reccomendations are provided in the table which follows.

LID SURGERY

Surgical intervention for distorted eyelids and inturned eyelashes has an immediate effect in preventing blindness and includes the following components:

Case finding :

(a) Identification in the community by local health workers or others; or,

(b) Screening of the population by specially trained personnel.

Provision of corrective surgery :

(a) Referral to nearest district hospital or secondary centre where lid surgery available; and/or,

(b) Mobile teams to do case finding and carry out surgery every 12 to 48 months.

Temporary measures that can be used if surgery is not immediately available :

(a) Application of tetracycline or other antibiotic ointment twice daily.

(b) Periodic removal of individual lashes that are irritating or damaging the cornea.

CHEMOTHERAPY OF TRACHOMA

Suggestions for the control of active infectious trachoma (MacCallan Stages I, II or III; severe, moderate or mild intensity trachoma)

These are general guidelines and should be modified to meet the goals of individual trachoma control programmes.

Prevalence of active trachoma	Basic treatment	Additional treatment	Eye health promotion
In children under 10 years, more than 20% with any active trachoma or 5% or more with moderate or severe intensity disease.	Mass treatment with topical antibiotics: topical application of a tetracycline ophthalmic ointment (usually 1%) to the eyes twice daily for 5 consecutive days, or once daily for 10 days each month for 6 consecutive months or for 60 consecutive days. An alternative antibiotic is erythromycin.	Selective treatment of severe or moderate intensity cases with systemic antibiotics or sulfonamides, only under medical supervision in well monitored programmes (for limitations, see footnote*). Distribution of ointment to families for self-treatment.	Improvements in personal hygiene and community sanitation, including: fly control; improvement of community water supplies and waste disposal; distribution of antibiotic ointment during annual outbreaks of purulent conjunctivitis.
In children under 10 years, from 5% to 20% with any active trachoma.	Mass or selective topical antibiotic treatment.	Selective treatment as described above. Distribution of ointment to affected families for self-treatment.	Same as above.
Less than 5% active trachoma or sporadic cases in children under 10 years.	Selective topical treatment with antibiotics.	Distribution of ointment to affected families.	Case finding among family members and close contacts.

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* Oral therapy with tetracyclines can be recommended only on a selective basis for severe and moderate intensity cases under medical supervision during drug administration and only for children over 6-8 years of age and adult males. Potential hazards of tetracyclines include photosensitization (worse with dimethylchlor-tetracycline), staining of teeth in children under about 7 years of age (least marked with oxytetracycline and doxycycline), slowing of bone growth during the period of administration, and gastrointestinal disturbances. For pregnant women and nursing mothers, tetracyclines are not recommended because of the possibility of adverse effects on the foetus and erythromycin may be given instead. Systemic sulfonamides are also effective, but carry a substantial risk of allergic reactions, some of which are serious and life-threatening. Furthermore, the wide use of oral tetracyclines, erythromycin and sulfonamides may result in the emergence of resistant bacterial pathogens.

CHAPTER 2 : BLINDING MALNUTRITION

2.1 PRESENT STATE OF KNOWLEDGE

Blinding malnutrition (xerophthalmia, keratomalacia) results from lack of Vitamin A, often in a background of general malnutrition.

Vitamin A participates in many bodily functions, including growth and immune competence. The earliest and most dramatic effects of Vitamin A deficiency involve the eye. Vitamin A is necessary for synthesis of photo-sensitive pigments of retinal cells and for normal differentiation of mucous secreting epithelial structures. Deficiency results in night blindness, keratinization of the conjunctiva and cornea, and ultimately corneal ulceration and melting.

Multiple factors affect Vitamin A status. One of the most important is adequacy of vitamin and provitamin A intake. The recommended intake of otherwise healthy pre-school-age children is approximately 300 to 400 g retinol palmitate (Vitamin A) per day. Populations at risk of nutritional blindness generally receive most of their Vitamin A from provitamin-rich fruits and vegetables. Such foods are often seasonal. When available, intake must be many times daily requirements to ensure adequate liver stores during periods when availability and consumption are low.

Diarrhoea, worm infestation and other intestinal disorders impair Vitamin A absorption, while respiratory tract infection, measles and other febrile illnesses increase metabolic demands, and often interfere with normal feeding. Protein-energy malnutrition is an added burden and interferes with absorption, storage and utilization of the vitamin. Where these contributory factors are common, dietary requirements are increased. In some instances corneal destruction may be exacerbated by secondary bacterial infections.

EPIDEMIOLOGY

Nutritional blindness can occur at any age. The various contributory factors occur most frequently among young children of disadvantaged communities, who are, therefore, at highest risk of xerophthalmia. Severe, blinding corneal destruction in particular is largely limited to the first 4 to 6 years of life, and is especially frequent among those 6 months to 3 years of age.

The younger the child and more severe the disease, the higher will be the mortality. A majority of the cases of corneal destruction that fail to receive medical attention probably die.

Since the factors responsible for Vitamin A deficiency are generally shared by other members of the family and neighbourhood, cases of xerophthalmia have a tendency to cluster within specific geographic areas.

Roughly 5 million children develop xerophthalmia every year. Half a million develop active corneal involvement and of these half go blind.

Nutritional blindness is endemic in much of Asia, with scattered foci in the Caribbean, Latin America and the Middle East. Cases of classical xerophthalmia have been reported from many areas of Africa, particularly communities in which provitamin A-rich Red Palm oil is not regularly consumed. Most childhood blindness in Africa is ascribed to measles. It is as yet unclear, however, if measles is simply precipitating acute, severe xerophthalmia among children of borderline Vitamin A and protein status.

DIAGNOSIS

Uncomplicated, gradual Vitamin A depletion results in clinical changes of increasing severity. The earliest manifestation is night blindness. The affected child has difficulty seeing under reduced levels of illumination. Among populations in which xerophthalmia is endemic, a history of night blindness of recent onset in a young child almost invariably indicates Vitamin A deficiency.

With more advanced disease, keratinizing metaplasia of the conjunctiva becomes apparent as an oval or triangular area of dry, nonwettable irregularity, lateral to the cornea, known as conjunctival xerosis. With more severe deficiency, conjunctival involvement is more extensive. When foamy or cheesy material composed of desquamated keratin and bacteria cover the dry surface the lesion is known as a Bitot's spot. Conjunctival xerosis or Bitot's spots in young children usually indicate Vitamin A deficiency. In older individuals these spots are often inactive sequelae of earlier disease.

Corneal xerosis begins as a hazy, dry, nonwettable change in the inferior aspect of the cornea. With more severe deficiency the changes become more striking and cover more of the corneal surface.

The foregoing abnormalities are all reversible. Once there has been loss of corneal substance (stroma), however, scarring results. The mildest form of stromal loss is small, circular or oval, sharply circumscribed corneal ulcerations of varying depth. These are usually eccentric and readily plugged by iris, thereby preserving the basic integrity of the eye. Prompt treatment results in a small peripheral scar; good vision is usually retained. Focal areas of corneal necrosis (keratomalacia) may have a similarly happy outcome. These begin as opaque, bulging masses, most or all of which may liquify and bare the iris below. When one-third or more of the corneal surface is involved, however, vision is often permanently reduced, either by central scarring or loss of intraocular contents. Prompt therapy is still imperative, to preserve what little vision may remain in either eye, and to save the child's life. Complete corneal necrosis results in extensive scarring (leukoma, adherent leukoma) and a deformed (staphylomatous) or shrunken (phthisical) globe.

Xerophthalmia does not always occur in the sequence outlined above. Acute decompensation of borderline Vitamin A status, as sometimes in measles, may result in rapid, extensive corneal destruction in eyes which had previously appeared perfectly normal. Feeding a high protein diet (lacking Vitamin A) to severely malnourished children may produce a similar picture because the attendant growth spurt rapidly exhausts the child's meagre Vitamin A reserves. Even with gradual, slow depletion, parents may be unaware of the presence of night blindness; and inflammation, that commonly accompanies corneal ulceration and necrosis, may mask conjunctival xerosis.

2.2 METHODS OF INTERVENTION

Before instituting an intervention programme, it is necessary to determine: whether and where nutritional blindness is a significant problem; dietary practices that might be contributing to the situation; the availability of natural dietary sources of Vitamin A and provitamin A; and the existence of potentially fortifiable food stuffs. Clinical data can be compared with established prevalence criteria defining a xerophthalmia problem of public health significance.

Prevention takes two forms: reducing the prevalence and severity of contributory factors (e.g. protein-energy malnutrition, respiratory tract infection, diarrhoea, measles) and increasing Vitamin A intake. Of the contributory and precipitating events, measles is probably the most preventable. An effective measles immunization programme would prevent a quarter to a half of the cases of nutritional blindness in some countries.

Increasing Vitamin A intake removes the basic, underlying cause of the problem. Even in the continued presence of contributory factors, adequate Vitamin A stores will prevent the vast majority of cases of nutritional blindness.

The most important, long-range solution is to ensure children consume adequate quantities of natural dietary sources of Vitamin A, protein and calories. Mothers should be encouraged to breastfeed their children, as breastmilk is generally the newborns' sole source of Vitamin A. By 6 months of age, provitamin A-rich foods, like mango and papaya, should begin to supplement breastfeeding. Dark green leafy vegetables should be added to the diet by one year of age. Few families of high risk communities can afford foods rich in the preformed vitamin (eggs, liver and dairy products), but small fresh fish, eaten whole (with their livers) are a good source of Vitamin A. Prolonged high temperature cooking may destroy the Vitamin A content of foods, and should be avoided.

Where Vitamin A- and provitamin A-rich foods are inexpensive and already available, nutrition education programmes are needed to motivate consumption in the high risk population. Where expensive or unavailable, introduction of home gardening and other horticultural activities may prove feasible. 100g of mango or 35g of dark green leafy vegetables will supply daily Vitamin A requirements of most young children. The greens should be lightly boiled, drained, and the excess water discarded, thus removing oxalates, cyanates and other potentially toxic substances. The child is less likely to avoid the greens if they are shredded into small pieces and thoroughly mixed with his staple (e.g. rice).

Where high risk groups consume little in the way of edible oils, these should be added to the diet to enhance Vitamin A absorption.

Periodic oral administration of massive doses of Vitamin A is a direct, short-term method of preventing xerophthalmia in high risk populations, in which it should be given to infants and their mothers within one month after delivery, to children 6 months to 6 years of age and, in regular small doses, to women of childbearing age. Vitamin A fortification of widely consumed foodstuffs or seasonings is an effective way to increase intake in high risk populations.

To treat children with xerophthalmia or any corneal ulceration, Vitamin A supplementation should be administered by the oral or intramuscular route. (See Tables 1 & 2, References and bibliography for recommended dosages.)

2.3 ACTION AT VARIOUS LEVELS

PRIMARY LEVEL

Where xerophthalmia is known to be a major public health problem, thought should be given to instituting emergency, generalized prophylaxis by periodically administering large doses of Vitamin A to the population at risk (see Table 2). The vitamin should be administered by village or urban level primary health care workers and under-five-clinics, as part of their regular routine.

In addition to routine distribution, the primary health care worker should examine every child for xerophthalmia (by enquiring about the presence of night blindness and seeking evidence of Bitot's spots and corneal ulceration).

Children with xerophthalmia or any of the major contributory conditions (diarrhoea, respiratory tract infection, measles, protein-energy malnutrition) should receive oral Vitamin A on two successive days, and additional doses be given every 2 weeks to cases with severe, persistent protein deficiency until corrected. The contributory conditions themselves require attention. Cases failing to respond to therapy should be referred to a secondary facility, as should all cases of corneal ulceration or necrosis.

Because Vitamin A deficiency clusters in families and neighbourhoods, families of affected children, their neighbours, and if at all possible the rest of the village should be made aware of the potential seriousness of the problem and the ease with which it can be prevented. They should be provided with specific instructions about which locally available foods to feed their children and how best to prepare them.

SECONDARY LEVEL

Where village level workers are not available, primary xerophthalmia control is provided by static centres (clinics, hospitals, etc.). For the most part, these only reach children presenting of their own accord. Since Vitamin A deficiency clusters in communities, a modest outreach programme can be a cost-effective means of impacting on the problem. Centre personnel can visit the neighbourhoods from which the xerophthalmia cases arise, administer a massive Vitamin A dose to all pre-school-age children, and provide nutritional education to their families. Among cultures that readily recognize night blindness, teachers can instruct school children to report the condition when present among younger siblings. Centre personnel should respond to a positive report in exactly the same way as to a self-referred case.

Static centres often have better trained staff, more plentiful medical supplies, and in-patient facilities. They are, therefore, better able to handle cases of corneal ulceration and necrosis (and the severe illnesses commonly accompanying them) than are village-level workers. Centre personnel may also be able to supervise primary health care workers and provide them with refresher courses, feedback and encouragement.

TERTIARY LEVEL

There is little need for sophisticated, tertiary level care in the treatment of nutritional blindness. Prompt Vitamin A therapy will usually preserve useful vision whenever that is still possible. Those blinded from xerophthalmia rarely benefit from corneal transplantation.

2.4 ORGANIZATIONAL ASPECTS

PLANNING AND INTEGRATION

Central staff must first determine, through various assessment techniques, integrated with other assessments where practicable, whether nutritional blindness is a significant problem; areas in which it is most severe; and the reasons responsible for its presence. An appropriate intervention strategy will reflect this information, available resources and the existing health care delivery systems.

Some strategies, like fortification, are necessarily centralized and often national in character. Implementation requires choice of an appropriate foodstuff or seasoning and level of fortification; passage of enabling legislation; and maintenance of strict monitoring of the final product, both as it leaves the factory and at the periphery, since transport and storage may affect its composition.

The central level is often responsible for preparation of nutrition education campaigns and material (messages or "spots" for use by radio, television and cinemas; and posters, flipcharts and other visual aids required by workers at the peripheral level).

TRAINING

All levels of health personnel need to be properly informed about nutritional blindness and its prevention. The content of such training will depend, of course, on the nature of the individual's involvement with the disease. Physicians, medical officers and graduate nurses often represent the ultimate source of information, supervision and motivation at the secondary and tertiary levels, and therefore need to be familiar with all aspects of the problem. Brief, periodic refresher courses will stimulate their interest and maintain their competence.

A more simplified, practical curriculum is appropriate for the training of primary health care workers. Emphasis should be placed on the seriousness of the problem; the fact that it arises from faulty, correctable dietary practices (lack of breastfeeding, and late introduction of locally available Vitamin and Provitamin A-rich foods); and that children with protein-energy malnutrition, diarrhoea, respiratory tract infection, measles and any severe illness are at high risk of nutritional blindness, as are apparently normal children living in the immediate vicinity of an active case of xerophthalmia. Workers should be able to recognize, though not necessarily classify, night blindness, Bitot's spots, corneal ulcers and necrosis; understand the need for prompt, massive dose Vitamin A therapy and correction of underlying systemic diseases; and know how to refer children with severe disease (inflamed, ulcerated eyes) to secondary facilities after initiating emergency massive dose therapy. Supervision, feedback and periodic re-training by higher level medical personnel, or specialized primary eye care workers is essential for maintaining motivation and competence.

Primary health care workers should be capable of providing village-level nutrition education to families and neighbours of affected children. Regular, village-wide nutrition education campaigns, however, are often delegated to specialized nutrition or general health education personnel. In either instance, methods for increasing Vitamin A intake should be provided in the context of general dietary improvement and the prevention of protein-energy malnutrition.

Training aids and clinical recognition cards, already available through WHO and other agencies, may prove useful, but should be tailored to local needs.

EVALUATION

Evaluation should be an integral part of any programme. Some techniques are extremely simple, such as monitoring the number of Vitamin A or measles doses distributed. But these do not reveal whether or not the children ever received them. For more definitive assessment, special recording procedures need to be established at the family level. Spot checks of family-retained household health cards can then establish the proportion of target children who actually received the agent. Both of these techniques assess the process. To assess impact, i.e. whether the programme is actually reducing the number of children going blind, clinical information must be collected. One simple technique is to establish and periodically review standardized recording of xerophthalmia cases encountered by selected village level health workers, clinics and hospitals operating in high risk areas. More definitive assessment requires periodic examination of a random sample of all pre-school-age children residing in such areas. As a general rule, individuals directly responsible for implementing the programme should not be the same as those evaluating it. But close coordination between the two is essential, since evaluation should indicate methods by which the programme can be improved.

VITAMIN A TREATMENT SCHEDULE

Timing	Dosage[1]
Immediately on diagnosis	200 000 IU by mouth (110mg retinol palmitate) or 100 000 water miscible IU by intramuscular injection (55mg retinol palmitate)
Next day	200 000 IU (110mg) by mouth
Prior to discharge; if clinical deterioration occurs; or once every 2 weeks (in kwashiorkor)	200 000 IU (110mg) by mouth

VITAMIN A PROPHYLAXIS SCHEDULE

Individual	Oral dose of retinol palmitate		Timing
Children 12 months of age	55mg	(100 000 IU)	Once every 4-6 months
Children 12 months of age	110mg	(200 000 IU)	Once every 4-6 months
Newborn	27.5mg	(50 000 IU)	At birth
Women of childbearing age	165mg	(300 000 IU)	Within one month of giving birth
Pregnant and lactating women	2.75mg	(5 000 IU)	Every day
	or		
	11mg	(20 000 IU)	Once every week

1 Children below 12 months of age should receive doses of only half this size.

CHAPTER 3 : ONCHOCERCIASIS

3.1 PRESENT STATE OF KNOWLEDGE

GENERAL ASPECTS AND EPIDEMIOLOGY

Onchocerciasis is a blinding, parasitic disease caused by a filarial worm, Onchocerca volvulus, which is transmitted from person to person by the bite of Simulium flies. The disease affects 20 to 30 million persons, and is responsible for at least several hundred thousand cases of blindness.

Its geographical distribution depends on that of the vector of the disease. In tropical Africa all countries are affected between the latitudes of 12°N and 15°S, and in Central and parts of South America (Mexico, Guatemala and Venezuela) there are quite large foci. In other countries of South America (Colombia and Amazonian Brazil) and in the south-west of the Arabian Peninsula (Yemen) onchocerciasis affects a very limited number of persons.

Man is the final host in which the adult forms of the parasite live in either an encapsulated or a free state. The female worm releases embryos, or microfilariae, which invade the tissues and involve not only the skin and eye, where they are very easy to demonstrate, but also the internal organs.

Microfilariae are ingested by female blackflies when they bite and take their blood meal from an infected person. They develop in the fly for an average of 7 days until they attain the infective form which is reinjected into man by biting. These infective larvae eventually develop into the adult male and female worms, which in some cases form easily recognized nodules under the skin. The adult female is capable, after fertilization, of releasing myriads of microfilarial embryos which can initiate a new cycle. The life span of the adult parasite may exceed 10 years, the maximum being 15 years, and man apparently constitutes the only natural reservoir of parasites.

The blackfly vector lives near rivers, where it lays its eggs in fast running water. In West Africa it can fly more than 100 kilometres, and so colonize rivers very quickly. The blackfly bites man in the daytime. These bites are a source of substantial discomfort, as the number of bites per person per day may reach several thousand.

The pattern and severity of the disease varies from one geographic area to another. This appears to depend on the intensity of transmission and possibly on differences in the parasite and its vector.

THE MANIFESTATIONS OF ONCHOCERCIASIS

Onchocerciasis is a cumulative parasitosis. In general, cutaneous and ocular manifestations in a given population increase with increasing numbers of bites by the flies and with higher numbers of parasites detectable in the skin. In hyperendemic areas, the disease usually becomes clinically apparent in young adults. The main general signs include the presence of palpable subcutaneous nodules, itching and a fine papular rash, which is easily overlooked. In later stages there is usually atrophy of the skin, and also changes in pigmentation.

Onchocercal involvement of the eye causes lacrimation, photophobia and itching. Pain may result from iritis and glaucoma. Usually, however, the disease progresses insidiously over several decades. Night blindness and narrowing of the visual field commonly occur at an early stage of the disease. Serious impairment of vision often develops more rapidly in the late and irreversible stages of the disease.

The early onchocercal corneal manifestation, punctate keratitis, is reversible. However, the more severe chronic sclerosing keratitis, which is painless, constitutes an important cause of permanent visual loss, as do the lesions in the retina and optic nerve.

The ocular lesions constitute the most disabling manifestation of the disease. In some African savanna villages the prevalence of onchocercal blindness may be as high as 10% of the total population, and severe eye complications may be present in more than 40% of the adults.

Onchocerciasis is most easily diagnosed by the skin snip technique which is an easy and safe test that can be performed by a laboratory auxiliary. The test provides evidence of the parasite in the skin, and counting the parasites gives a quantitative evaluation of the cutaneous parasite density.

In many African villages, close to large breeding sites of Simulium damnosum, there is often a great social burden due to a large blind population. Under these conditions the adolescents and young adults in the village tend to migrate to seek work elsewhere, and the entire community may disintegrate with abandonment of the village.

In many onchocercal infected areas of West Africa vast areas of cultivable land alongside rivers are uninhabited. In areas with high rates of microfilarial transmission, and hence a large proportion of disabled persons, a population density of less than 50 persons per square kilometre constitutes a critical threshold for total desertion of the land.

3.2 METHODS OF INTERVENTION

TREATMENT

The goal of treatment is the elimination of the adult worms and microfilarial embryos of O. volvulus from patients without increasing serious adverse reactions. This is difficult to achieve with available drugs and carries some risk even with expert supervision. Even a reduction in the microfilarial load is useful in preventing severe ocular lesions.

The available methods include :-

(a) Surgical removal of the onchocercal nodules, or nodulectomy, which is of doubtful efficacy, except for some cases with head nodules at an early age.

(b) Chemotherapy, which relies mainly upon diethylcarbamazine-citrate (DEC-C), which efficiently kills microfilariae, but which carries a risk of acute adverse reactions, including optic neuritis. The other drug available, suramin, efficiently kills adult worms, but is toxic.

Considering the drawbacks of the two available drugs mentioned, treatment of onchocerciasis cannot be undertaken on a large scale. Both DEC-C and suramin may give rise to very serious adverse reactions, particularly in heavily infected patients, and thus the need for strict medical supervision becomes imperative. A short course of treatment with corticosteroids in the initial phase of a DEC-C course has proved beneficial to reduce the side-effects, and anti-allergic drugs may also be useful to that effect. As a general rule, chemotherapy of onchocerciasis should be considered on an individual basis, and strict indications for treatment should be applied, taking into account possible iatrogenic effects of repeated treatment courses, needed in hyperendemic areas.

Their advantages and disadvantages, dosage schedules and main therapeutic indications are summarized in the accompanying table. The main indications for treatment are severe itching, dermatitis or the presence or risk of progressive ocular lesions.

The treatment of ocular onchocerciasis and its complications requires specially trained personnel with appropriate diagnostic and treatment facilities.

Repeated treatment courses utilizing DEC-C at high dosage are probably potentially dangerous, provoking an aggravation of the ocular disease, but weekly doses of DEC-C may be useful in preventing severe ocular lesions from ensuing. However, such suppressive chemotherapy is tolerated only if the load of microfilariae is fairly low, which may necessitate initial intense treatment with DEC-C under steroid cover and strict supervision.

PREVENTIVE MEASURES

The current (1982) main strategy for prevention of onchocerciasis is based on the control of the blackfly breeding sites. This can be achieved by means of application of larvicides in the infested water courses, or by building dams and thereby submerging the breeding sites. Experience has shown that larvicidal campaigns can be successfully implemented on a large scale, but the high cost of such campaigns is a limiting factor. The blackfly vector, Simulium neavei, and onchocerciasis were successfully eradicated by DDT from an isolated focus in Kenya (1950). This is the only known instance of eradication of the blackfly vector. Elsewhere (in Chad and Nigeria) operations of this type against the vector S. damnosum have been unsuccessful.

At present, a programme for control of onchocerciasis by aerial treatment with modern, biodegradable insecticides in large foci covering seven West African countries has resulted, after 5 years, in satisfactory control of the vector over 80% of the treatment zone. The wide distribution of the vector S. damnosum makes it necessary to treat large areas. These operations are very costly for technical and logistic reasons and it will probably be difficult to apply them without modification in other onchocerciasis foci.

The development of a new, highly effective, and non-toxic anti-blackfly larvicide (Bacillus thuringiensis H14), will probably enable larval control measures to be implemented more easily.

Some large dams, constructed for economic reasons, have made it possible in certain African countries to eliminate the blackfly vector over hundreds of kilometres of river. Small dams have little effect but may even lead to the creation of artificial breeding sites on the reservoir, and to an associated increase in schistosomiasis and malaria.

The interruption of transmission by medical treatment of the human parasite reservoir is not feasible because of difficulties in using the available drugs.

Where the vector has not been controlled, it is possible to prevent blindness by selective medical treatment of persons at ocular risk. In each focus, it would involve only a limited number of patients. The individuals at greatest risk of blindness and most in need of treatment are usually males aged 15-45 years who live in first-line villages (i.e. those nearest to the Simulium breeding sites).

The exposure to the transmission of O. volvulus can be reduced by the following means :

(a) Displacement of villages away from breeding sites, and hence their traditional water source depends on the provision of an adequate water supply in the new village.

(b) Clearing of land to raise its occupancy rate which may, under certain circumstances, reduce the number of bites suffered by each person.

Individual protection can be achieved by the use of repellents and protective clothing, especially long trousers, light boots, long-sleeved shirts with close fitting wrists. However, these are difficult for farm workers to use in conditions encountered in their daily work.

Chemoprophylaxis with drugs is not possible. Suramin is active against infective O. volvulus larvae, but is dangerous at dosages that would be effective for chemoprophylaxis.

3.3 ACTION AT VARIOUS LEVELS

In order to provide the training and supervision needed for control of onchocerciasis, it may be necessary initially to have special teams devoted only to onchocerciasis and prevention of blindness work in the area concerned. Such teams should form a mobile but integral part of the primary health care system.

PRIMARY LEVEL

The local primary health care worker should be capable of recognizing onchocercal nodules and referring patients with visual loss, painful eyes or severe dermatitis. The health care worker could also supervise self-administered suppressive chemotherapy to selected patients with DEC-C (one tablet to be taken per week), following initial intensive treatment under supervision. They can also treat skin lesions, which are always to some degree infected, with simple antiseptics. The primary health care worker should take an active role in disseminating appropriate information about onchocerciasis and the community participation in its control, including elimination of local breeding sites, local larvicidal control and responsibility for individual protection.

The indiscriminate use of DEC-C tablets in onchocerciasis areas should be discouraged.

SECONDARY LEVEL

At this level, a more accurate assessment of onchocerciasis should be made by means of quantitative skin snips, palpation of nodules and more precise evaluation of visual disorders. Cases in need of specific treatment can, thus, be identified.

All the therapeutic procedures (nodulectomy, treatment with DEC-C and suramin) can be performed at the secondary level, provided there is adequate training and supervision. The first few days of DEC-C treatment must be monitored with particular care, as short courses of corticosteroids are often necessary to reduce the initial reactions.

TERTIARY LEVEL

The tertiary centre should provide appropriate training in the management of onchocerciasis for the workers at the secondary level. It is also of importance to provide continuing in-service training, supervision and support for workers in their own hospitals and health centres.

3.4 ORGANIZATIONAL ASPECTS

PLANNING AND INTEGRATION

The control of onchocerciasis requires a strong planning at the central level, because there is a need for coordinated action at the national and intercountry levels. Baseline data on foci of onchocerciasis and the gravity of the disease must be collected, including necessary entomological information.

The integration of onchocerciasis activities with other health programmes is often difficult, but should be considered whenever feasible. Certain activities in the field may be integrated into the tasks of mobile teams dealing with other vector-borne diseases.

EVALUATION

The evaluation of control measures against onchocerciasis is complex, considering the vectorial aspects as well as the disease itself. The monitoring of any larvicidal campaign will necessitate a comprehensive entomological surveillance scheme. However, the interruption of transmission of O. volvulus also needs to be confirmed by epidemiological studies, as there should, in that case, be no new cases of onchocerciasis in previously non-infected individuals. A substantial reduction of the transmission of O. volvulus will change the pattern of clinical manifestations of onchocerciasis over time, including the ocular lesions, and this must be followed up in carefully planned epidemiological studies.

TRAINING

Health education, focusing on information on onchocerciasis, its main manifestations, transmission and risk signs, may be of great value, provided there are adequate follow-up facilities. The role of the community, and possible interventions against the disease at the community level, should be emphasized in information campaigns.

The training of personnel at the primary level should focus on the main signs of onchocerciasis and particular risk factors of serious ocular involvement, such as presence of head nodules in children and impairment of vision. Clear criteria for the referral of such patients should be given to the village health workers concerned.

At the secondary level, the personnel should be familiar with onchocerciasis in greater detail, particularly the quantitative assessment of an onchocercal infection and main indications for chemotherapy. The ophthalmological examination at this level should, if possible, be quite detailed, which is of great importance for the establishment of therapeutic indications. A close collaboration between primary and secondary levels must be promoted, and the training of the personnel concerned should consider the actual field conditions as much as possible.

At the tertiary level, specialized training should be provided to entomological and medical personnel as required. This can often be arranged on the basis of Technical Cooperation among Developing Countries (TCDC), which is of particular interest in the field of onchocerciasis control.

THERAPEUTIC METHODS OF ONCHOCERCIASIS CONTROL

Means of Treatment	Advantages	Drawbacks	Therapeutic Indication or Dosage (Patient weighing 60 kg)
NODULECTOMY (surgical excision of onchocercal nodules)	(1) Demanded by patients. (2) Risk-free (except at joints and coccyx).	(1) Reaches only a small proportion of the adult worms. (2) Consequently, reduces parasite load only slightly and does not protect from eye complications.	(1) On request, in individual medicine. (2) In children, excision of head nodules, which may help to reduce parasite load and ocular risk.
DIETHYLCARBAMAZINE CITRATE (DEC-C) Tablets containing 50mg or 100mg	(1) Highly effective reference microfilaricide. (2) Non-toxic.	(1) Very severe pathological reactions at start of treatment (pruritus, oedema of limbs, fever, vertigo, etc.). (2) No macrofilaricide action. Need for repeated courses of treatment, the microfilarial load building up again within 3 months. (3) Possible ocular complications.	(1) In areas of reinfection - treatment of lightly infested individuals with skin disorders: total dosage 3g over 21 days. Corticosteroids may be necessary in heavily infested patients to control initial adverse reactions but ocular complications may ensue due to DEC. (2) Other than in endemic zones - radical cure of lightly infected subjects with skin disorders but no severe eye complications. Dosage as above.
SURAMIN Vials containing 1g powder to be dissolved in distilled water. Injectable intravenously by slow injection.	(1) Highly effective macrofilaricide. (2) Partial microfilaricide action. (3) Radical cure of heavily infected subject possible if not reinfected. (4) Toxic effects controllable under medical supervision.	(1) Toxic - Kidney damage; - Peripheral neurological complications; - Impairment of patient's general state. (2) Adverse reactions - Ulceration of upper respiratory passages - Dermal exfoliation; - Abscess; - Possible ocular complications. (3) Strict medical supervision	Patients at high ocular risk: - Heavy ocular microfilarial load. - Onset of severe ocular complications. - Hyperendemic area of residence. - 1 injection per week at progressively increasing dosages adjusted to actual weight Week 1 : 0.20g; Week 2 : 0.40g; Week 3 : 0.60g; Week 4 : 0.80g; Weeks 5-6 : 0.80g, or possibly 1g. - Total dosage: 4g - 6g. - Albumin test, and check for adverse reactions before each injection. - Repeat course of treatment in areas of reinfestation.

CHAPTER 4 : CATARACT

4.1 PRESENT STATE OF KNOWLEDGE

DESCRIPTION

The loss of vision from cataract is a major cause of blindness in developing countries, which can be treated successfully with existing technology. Because cataract prevalence increases markedly with age, blindness from cataract in developing countries will increase very rapidly due to a five-fold increase expected in the number of people over 55 during the next fifty years. Even in those areas with other blinding diseases such as trachoma and onchocerciasis, cataract is still a major cause of blindness.

Cataract is generally defined as any opacity of the crystalline lens of the eye. Minor lens opacities are extremely common and rarely interfere substantially with vision. More extensive lens opacities interfere with light rays passing through the crystalline lens and cause distortion or complete absorption of light falling on the retina.

About 85% of cataracts are classified as senile, the causes of which are unknown. There are many known causes of cataract, but these account for a relatively small percentage of the total number of cataracts. The present understanding of the complex biochemical and structural events leading to formations of senile cataract is quite incomplete.

Although not a major cause of loss of vision, congenital cataract is of particular importance because it affects infants and young children and therefore, if left untreated, causes lifelong blindness. At the present time, these cases are usually treated surgically at tertiary eye care centers because general anesthesia is required and the surgical procedures are much more technically demanding than routine senile cataract surgery.

In those countries where cataract is a major blinding condition and where most of the ophthalmologists' efforts are devoted to cataract surgery, it is essential that the accumulation (backlog) of unoperated cataracts be eliminated as soon as possible. Once an extra effort has been made to eliminate this backlog, it is possible to cope with the annual incidence of new cataract cases with available resources. The backlog should be estimated, and a time limit - not more than 5 to 10 years - should be set for its elimination. Governments and nongovernmental agencies should adopt policies which would encourage and facilitate cataract surgery in the rural areas until the backlog is reduced. If sufficient numbers of national ophthalmologists or surgical technicians are not available, appropriate manpower should be trained, and in the meantime other solutions be explored such as short-term assistance from expatriate volunteer organizations.

EPIDEMIOLOGY

Magnitude of the problem : Although the biochemistry of cataract formation has been studied extensively, there has been relatively little research on the distribution and probable causes of cataracts in human populations. There are three major ways to study the magnitude of the cataract problem: (1) prevalence surveys, (2) blindness registries and model reporting areas, and 3) number of operations performed.

Prevalence surveys reported from developing countries indicate that cataract is the major cause of severe visual impairment. It accounts for about 50% of blindness, with overall rates of blindness between 1 and 3 per cent of the population. Cataract as a cause of blindness appears in the fifth decade in India compared to the sixth or seventh decade in most industrialized countries. A contributing factor to the high prevalence of cataract in the developing world is the lack of an effective eye care delivery system.

Blindness registries are almost always incomplete, but in certain countries such registries may give some idea of the relative importance of the different causes of blindness. The Model Reporting Area (MRA) for Blindness Statistics in the USA revealed that cataract accounted for 12% of blindness.

The number of operations for cataract may provide a rough measure of the need for medical care that would be generated by cataracts in a particular population, but these rates are influenced by a number of factors such as the availability of service, the visual requirements for the population in question, and the willingness of patients to undergo surgery. Moreover, surgical rates reflect the number of operations performed, so do not represent the number of individuals with cataract who may eventually have bilateral surgery. Although the annual rates of cataract surgery are not available for developing countries, data have been obtained in industrialized countries where they vary from 55 to 167 per 100 000 population.

Risk factors in cataract formation : Some studies suggest that lens opacities progress more rapidly in diabetics and that this progression occurs faster in diabetic women than in men. Another suspected risk factor, ultraviolet light and/or sunlight, has long been felt to be a factor leading to cataract formation. X-rays are known to induce human cataracts. For a single radiation exposure, all doses over 200 roentgens (R) regularly produce cataract. Oral and topical corticosteroids and certain other drugs also produce cataract. It is possible that under-nutrition may favour the development of cataract at an earlier age.

4.2 METHODS OF INTERVENTION

The diagnosis of a clinically significant cataract is well defined and can be carried out by health personnel after minimal training. The major problem is that of case finding. The development of an efficient cataract surgery programme requires sample surveys to identify the magnitude of the problem, strategies for identifying and attracting cases to either a hospital or eye camp, and information about who will benefit from surgery. It is important to understand the social and behavioural factors that interfere with the individual patient's utilization of cataract surgery programmes. The methods of case finding, recruitment, flow of patients and pre- and post-operative care of patients can vary from one country to another and even from one region to another in the same country.

There is no drug treatment for cataract, but sight can be restored by surgical removal of the opaque (cataractous) lens and then by the provision of corrective spectacles or other devices. Appropriate technology is available to manufacture cataract spectacles at low cost.

4.3 ACTION AT VARIOUS LEVELS

PRIMARY LEVEL

The initial intervention usually takes place at the primary level where locally available health-care personnel such as the village health worker or a volunteer can be trained to screen for visual acuity and identify those patients whose acuities are equal to or less than a pre-determined level, usually 3/60 or 6/60. Further examinations to detect cataract can be carried out at the primary level or could be referred directly to a secondary level of care.

SECONDARY LEVEL

The usual secondary level of care in most developing countries is the local hospital which is staffed by a general medical practitioner and medical auxiliaries who have been well trained to assist the general practitioner. Occasionally an ophthalmologist may be available or at least a surgeon or general medical officer who has received training in cataract surgery. Cataract surgery should occur at the secondary level where it can be performed either in local hospitals, satellite eye hospitals or mobile eye camps.

TERTIARY LEVEL

Tertiary facilities are primarily oriented towards taking care of more complicated cases such as congenital cataracts requiring general anesthesia, cataracts accompanied by other diseases of the eye, such as glaucoma or iritis, or cataracts associated with systemic diseases such as diabetes that may complicate the pre- and post-operative care of the patient. In addition, the tertiary hospital may serve as a base for the development of satellite hospitals and mobile eye units.

4.4 ORGANIZATIONAL ASPECTS

PLANNING AND INTEGRATION

In local hospitals, ophthalmologists, well trained in cataract surgery, can deliver eye care to patients coming to the hospital. Where local transportation is well developed, this is a feasible approach, especially when the base hospitals are located in smaller cities relatively close to rural areas. However, since most such hospitals are located in large cities, and the majority of people in the developing world live in rural areas, these hospitals are not ideally located for the delivery of eye care to the outlying rural population. Therefore, an outreach programme may be necessary and can be integrated with the district hospitals that are more accessible to the rural population.

Under certain conditions the establishment of rural eye hospitals may be appropriate. These could be either general hospitals equipped and staffed to perform eye surgery, or a satellite eye hospital specifically organized for the delivery of eye care in the rural setting. Such satellite hospitals would serve the purpose of not only taking care of the backlog of cataract cases but keeping up with new cases as they occur. Complicated cases or cases requiring specialized treatment such as retinal detachment surgery or vitrectomy would be sent to the referral hospital.

The mobile eye unit is a third delivery approach and can serve both rural and urban areas where permanent infrastructure for eye work is inadequate. This eye camp approach is already established in some countries and is working satisfactorily to deliver the services at the peripheral level. This approach requires detailed advance planning and community participation.

TRAINING

The personnel required will vary according to the needs in each country and this personnel may include ophthalmologists, both at a senior and junior level, residents-in-training, ophthalmic assistants, ophthalmic technicians, nurses, and voluntary or nonvoluntary aides or helpers. If enough ophthalmologists are available, they could perform the cataract surgery. On the other hand, in countries where the number of available ophthalmologists is insufficient to remove cataracts in remote and disadvantaged communities, the identification and training of general practitioners or other surgeons to organize and perform cataract surgery may be desirable. In instances where ophthalmic assistants or general nurses have received extensive training in cataract surgery, they may perform the surgery under supervision.

Auxiliary personnel play an important role in cataract surgery delivery. These may include categories such as ophthalmic assistants who refract patients, measure intraocular pressure, irrigate nasolacrimal sacs and assist at surgery, nurses who manage pre- and post-operative patient care, and aides or helpers who take care of the routine day-to-day activities in the hospital or mobile eye unit. Of greatest importance is a flexibility of approach in addressing manpower needs.

EVALUATION

A periodic review of progress in reducing the magnitude of the cataract problem is important. This is best accomplished not by focusing solely on the number of operations performed, but on the number of cases that remain in the population as determined by sample surveys. Such information about the number and location of remaining cases is necessary for the efficient management of any program designed to eliminate blindness from cataract.

The performance of activities at every level should be evaluated periodically to ensure an adequate level of care. As part of assessing performance, sample surveys of patients who have undergone surgery should be done at intervals to evaluate the performance of the team as a whole.

CHAPTER 5 : OCULAR TRAUMA

5.1 PRESENT STATE OF KNOWLEDGE

DESCRIPTION

The prevalence of blindness due to ocular trauma and the nature of injury varies widely in different parts of the world. In the industrialized countries the main risks are industrial and automotive accidents. In the developing countries, the majority of injuries are from agricultural practices and cottage industries. In rapidly industrializing countries, eye injuries are particularly frequent because the hazards of the work place are not yet appreciated by workers or their supervisors. In recent years, the rapid development of the chemical industry has resulted in higher incidence of injuries by chemicals.

Blindness may be due to trauma itself or to secondary infection and sympathetic ophthalmia. The situation is exacerbated by the delay in proper management and by the use of inappropriate home medications. The eye condition invariably worsens, and complications appear when time is lost in applying home medication and delaying instituting proper management.

Trauma as a cause of blindness figures prominently in the list of causes of blindness and visual disability in many parts of the world, and has been variously reported from 0.8% in Zambia, 1.3% in India, 2.1% in China and Mali, 5.6% in Uganda, 6.7% in Sri Lanka to 9.4% in Fiji. It is also one of the common causes of absence from work. Thus, ocular injuries generate a need for costly medical care and result in economic loss in productivity.

EPIDEMIOLOGY

The pattern of incidence, type and severity of ocular trauma is constantly changing and is directly related to the setting in which it occurs, i.e. civil or military, industrial or agricultural, occupational or domestic.

Poor midwifery can lead to serious birth trauma to the eyes. In the first two decades of life, injuries are often common and severe. Children can damage their eyes by playing with potentially dangerous toys, sticks, fireworks and missiles (e.g. darts or arrows). Boys are more prone to get injured due to their participation in outdoor activities and aggressive games, and 3% to 7.5% of accidents involving the eyes and adnexa are caused by sports.

In adults, many eye injuries occur in domestic situations. In agricultural workers, injuries due to farming practices are significant, particularly from small foreign bodies, such as wheat spikes, rice husks, sugar cane leaves, etc. Exposure to toxic chemicals, particularly liquid ammonia, cause injury to the eye in both agricultural and in industrial settings. The worldwide increase in automobile accidents results in many cases of ocular injuries caused by contusions and splinters from the windshields. Acute and chronic damage to the eye is caused by a variety of electromagnetic radiations including infra-red, ultraviolet and ionizing radiations.

Occupational injuries account for a large proportion of cases. The nature of occupational trauma to the eye varies from country to country and in different case studies. In developing countries, cottage industries are responsible for many eye injuries from carpentry, blacksmithing, stone crushing, chiselling, hammering and wood chopping. During wars, combat-related blast injuries to the eyes are common.

5.2 METHODS OF INTERVENTION

In view of the varied nature of ocular trauma and inequalities in the availability of health services in remote areas, only general guidelines of methods of intervention can be recommended.

An epidemiological appraisal of significant eye injuries and their causes can identify the various risk factors and possible measures for their control.

PRINCIPLES OF PREVENTION AND TREATMENT

Management of ocular trauma as part of primary eye care forms an integral part of health services. Primary level health workers and the trained health personnel at peripheral posts should be able to organize preventive measures, manage ocular emergencies, and arrange appropriate referrals.

Improved services for maternal and child health care can avoid many cases of birth trauma; social and health education can reduce blindness caused by dangerous toys and games; increased awareness of the potential danger of agricultural, industrial and non-industrial practices, and the provision of basic facilities for first aid management, can help to reduce the magnitude of the problem.

Education for eye safety should be integrated in the school syllabus at various levels of education. Safe playgrounds and children's parks should be provided in schools and residential areas.

Films on industrial and non-industrial ocular injuries can be prepared and the mass media used to create awareness of the need to prevent accidents and protect eyes.

In addition to health personnel, school teachers, social workers, volunteers and senior level students can be trained to disseminate information on the prevention of ocular injuries.

Making the machine and methodology safe : The key to the prevention of accidents in factories is to improve the safety features of machines, to have proper illumination of the working area, to select workers with the requisite alertness and good vision, and to encourage the use of protective devices.

(a) Machine safety: Machine design should give high priority to the safety of the operator. A strict scrutiny of each machine is imperative before it leaves the factory to ensure that safety features are indeed in place. Periodic inspection and maintenance of these safety features should be done.

(b) Good illumination makes the job easier and safer. The present recommendation for the lighting standard in factories should be adequate.

(c) Every possible effort must be made to improve the handling and storage of chemical materials particularly injurious to the eye, such as caustics and acids.

(d) Protective devices for workers: the best method for individual safeguard against ocular trauma is the use of proper protective devices such as goggles, face masks, etc.

Visual standards and job placement : It is imperative that every prospective worker possesses the requisite visual efficiency to enable him to carry out his job without endangering himself or others. Guidelines for visual standards for various jobs in the factory need to be worked out. These should be grouped into (i) jobs requiring high visual efficiency; (ii) jobs requiring moderate visual efficiency; and (iii) jobs requiring low visual efficiency.

Pre-employment visual records must be maintained and periodic check-ups carried out to ensure the safety of workers. Workers must be informed of the possible hazards and how to prevent them in their work, and in the use of personal protective devices.

Rural industries : Ocular injuries in rural populations, though frequent, may be relatively minor and tend to heal without serious damage to the vision. However, secondary infection in these cases too often leads to gross visual impairment and blindness due to lack of simple and timely intervention. The use of protective devices for individuals should be popularized. Simple, inexpensive and safe mechanical devices should be found and made available to reduce direct manual handling of materials and livestock. Workers should accept responsibility for observing safety regulations.

The availability of primary eye care to treat minor eye injuries and to prevent secondary infections is most important to reduce blindness due to trauma in the rural sector.

Automobile accidents : To prevent ocular injuries in automobile accidents, adequate codes for safety devices, a strict procedure for the awarding of driving licences, and road rules need to be adopted and enforced.

Radiation hazards : The effect of infra-red radiation on glass blowers and the ill effects of U.V. rays, X-rays and gamma rays on the eyes are well known. Since World War II, there has been an increased awareness of radiation injuries to the eyes.

The use of radio-active materials in industry has introduced the potential danger of new hazards both to the individual workers and general population. The increasing use of laser devices in military, industrial and domestic settings also presents a real hazard to the eye, for which safety measures must be defined.

Mining injuries : There is a high incidence of blindness in the mining industry, particularly due to the use of explosives. The great majority of these accidents are preventable by proper safety measures and training of the workers.

5.3 ACTION AT VARIOUS LEVELS

PRIMARY LEVEL

The treatment and management of ocular injuries is an important part of primary eye care in both rural and urban settings. Basic supplies of drugs, instruments and dressing materials should be provided to manage eye injuries at primary health care level. It is of particular importance that antibiotic ointment be made available in rural areas.

The primary health care worker may remove conjunctival foreign bodies, but deeply embedded corneal foreign bodies are best dealt with by personnel with special training. If referral to the secondary or tertiary levels is not practicable because of distance, etc., it may be desirable to train primary health care workers in the removal of corneal foreign bodies, and to provide instruments, topical anaesthetics, antibiotic eye ointment and dressing material.

Each industry should have a provision for first aid and proper referral facilities for specialized care. Plants with potential risk of serious chemical hazards should evolve and maintain an 'emergency care service', with stress on preventive aspects, periodic dummy demonstrations, and provision for quick irrigation and flushing of injurious toxic substances from the eyes.

SECONDARY AND TERTIARY LEVELS

In addition to these emergency measures, some cases will need further treatment in the district hospital and more specialized treatment in special centres. Information regarding the eye casualty service and liaison with the hospital authorities should be maintained.

5.4 ORGANIZATIONAL ASPECTS

PLANNING AND INTEGRATION

Prevention of injuries is a matter of great social significance. Coordinating action by governmental and other agencies in the area of eye safety should be promoted through (i) school committees (consisting of teachers, students, parents and a health worker); (ii) village committees (local leaders and health workers); and (iii) industrial committees (employer, employees, engineers and a health worker). Eye safety guidelines and trauma surveillance should be established by these committees.

All the efforts in this direction should include dissemination of safety guidelines and of how to prevent ocular injury within the community. Managers of the industries must ensure that essential first aid measures are provided and that a record is kept of possible causes of ocular injuries.

Legislation should be promoted for :

(a) prohibiting the use of untrained labour for performing high risk jobs;

(b) the observance of minimum safety standards for workshops and factories with regard to lighting and number of working hours;

(c) banning the manufacture of fireworks and crackers;

(d) the mandatory provision and use of protective devices in high risk areas;

(e) the mandatory provision of first aid equipment and kits in the high risk industries.

EVALUATION

There is a need to evaluate the outcome of intervention methods and of the treatment given. A simple standard form may be used which includes (a) cause and severity of the injury, (b) extent of the initial damage due to trauma, (c) secondary infection and (d) extent of the ultimate damage.

TRAINING

Training of manpower in the prevention of ocular trauma would necessarily involve the training of those involved in safe design, usage and maintenance of machines. A close interaction between the medical and engineering personnel is imperative in this regard. Engineers in specific industries should receive short training courses on ocular hazards and how to prevent ocular injury.

Training and refresher courses should be organized for the factory managers, engineers, factory doctors and eye specialists to inform them of the latest advances in the field of prevention and management of eye trauma.

Science teachers in schools and colleges should be trained in safety measures and first aid management. Basic health workers need to be adequately exposed to relevant aspects of ocular trauma, with stress on prevention and first aid measures. Medical staff at the peripheral level and those associated with industries and emergency rooms should receive regular refresher courses on the epidemiology of ocular injuries, their prevention and treatment.

Persons working in hazardous occupations should have adequate practical training in their jobs before they operate machines or handle chemicals. The utility of protective eye wear should be explained and its use made mandatory. Such a training should be imparted by experienced personnel. Employees should be trained in simple first aid measures; such training should be practical and repeated periodically.

At the tertiary care level, expertise is desirable to deal with trauma and its ocular complications.

CHAPTER 6 : GLAUCOMA

6.1 PRESENT STATE OF KNOWLEDGE

DESCRIPTION

Glaucoma includes four main disease entities with the common feature of intraocular pressure high enough to cause impairment of the optic nerve and visual field, ultimately leading to blindness. The four disease entities are: (1) congenital glaucoma or buphthalmos, (2) primary open angle glaucoma (chronic simple glaucoma), (3) primary angle closure glaucoma (congestive glaucoma) and (4) secondary glaucoma.

Primary open angle and angle closure glaucoma account for the vast majority of cases of glaucoma blindness. Of the two, chronic open angle glaucoma is the more common, and also the more difficult to diagnose and treat.

Glaucoma is an important cause of blindness, both in developing and industrialized countries. It accounts for approximately 10% of all blindness. In developing countries with a large backlog of cataract, lens-induced secondary glaucoma adds to the magnitude of the problem.

Acute angle closure accounts for 10% of glaucoma in Caucasians, perhaps more in some Asian populations. It arises in individuals with small eyes and shallow anterior chambers under certain circumstances (commonly dilatation of the pupil) in which normal egress of aqueous from the eye is prevented, so that intraocular pressure rises rapidly, resulting in brow- or head-ache, and frequently nausea and vomiting. The cornea becomes oedematous and the patient may notice decreased vision or haloes about lights. The eye will usually appear inflamed, and will be firmer than the other eye. If unrelieved, a sustained attack of angle closure glaucoma will result in irreversible ocular damage and ultimately blindness, usually within 1 to 3 days.

An acute attack is treated medically, by lowering intraocular pressure with hyperosmotic agents and constricting the pupil with miotics. In most patients the condition can be permanently cured by peripheral iridectomy, a relatively simple operation that creates a hole in the peripheral iris, forming a permanent channel through which aqueous fluid can flow from the posterior chamber to the anterior chamber.

The disease is almost invariably bilateral. Although an acute attack usually involves only one eye at a time, the uninvolved eye is likely to suffer an acute episode within 5 to 10 years. For this reason, it has become popular to operate on both eyes, rather than only on the eye which has had the acute attack.

Primary open angle glaucoma, in contrast, is a slowly progressive, insidious disease caused by a moderate increase in resistance to drainage of aqueous from the eye, and is difficult to detect because it is asymptomatic. Its cause is unknown.

In cases with open angle glaucoma, there is usually elevation of intraocular pressure which leads to gradual destruction of optic nerve fibres with a resultant enlargement of the optic cup and progressive and characteristic alterations in the visual fields. Because the pressure rises slowly and often is not very high, and because central vision is retained until late in the disease, the patient is usually unaware of the problem until little can be done.

Intraocular pressure is usually elevated for many years before the onset of characteristic field loss, although patients with higher pressures tend to develop loss of visual field sooner. Chronic open angle glaucoma is thought to occur earlier and progress more rapidly in black populations than in white. Darkly pigmented individuals are also more refractory to therapy.

Unlike acute angle closure glaucoma, the recognition and treatment of open angle glaucoma is unsatisfactory, even in developed countries.

Congenital glaucoma (buphthalmus) is an uncommon condition in which elevated pressures during the first few years of life result in optic atrophy and often enlargement of the eyeball and cloudiness of the cornea. Management requires specialized surgery.

Secondary glaucomas are caused by a large number of ocular diseases. Prevention depends on the prevention or treatment of the underlying disease.

DIAGNOSIS

Acute angle closure glaucoma is diagnosed by the presence of pain, a red eye, a large pupil, cloudy cornea, visual loss and elevated pressure in an eye with a shallow anterior chamber.

The diagnosis of open angle glaucoma is much more difficult because patients are generally asymptomatic. It can only be made with certainty if facilities are available for examination of intraocular pressure, the optic nerve head and the visual fields. Special "screening" procedures are often carried out on large numbers of apparently healthy adults (over 30 to 40 years) in order to identify early cases. One of the easiest techniques for screening is to measure the intraocular pressure with a tonometer. Unfortunately, the ability of eyes to withstand elevated intraocular pressures varies widely, and unless the pressure is consistently very high (e.g. 30 or 35 mm Hg), it is impossible to predict how long it will take (if ever) for any particular eye to develop characteristic field loss.

A second method of screening is to examine the size and contours of the optic cup. Unfortunately, unless actually seen to enlarge over time, or be very large to begin with (e.g. occupying 80% of the optic nerve head diameter) it is impossible to be certain the patient has glaucoma, since many normal individuals have large optic cups. The combination of elevated pressure and large cups, or different sized cups in the two eyes, would suggest true glaucoma.

The third screening method is examination of the visual fields. By definition glaucoma is known to be present only when characteristic changes have appeared in the visual fields. But visual field examinations are time consuming and require a high degree of cooperation.

It is not uncommon, in developed countries, to use two-stage screening techniques: large populations are examined to detect those with elevated pressures and those found to have high pressures are referred for visual field examination. Unfortunately only 1 out of every 30 such people referred will actually have a glaucomatous field loss and one-third to half of those with field loss will have had a normal intraocular pressure when screened. "Screening" procedures are extremely inefficient, and even in developed countries, with comparatively enormous resources, results are not encouraging.

Late in the disease, the pupil will become moderately dilated and poorly responsive. If the disease has been asymetric, the other eye may still benefit from treatment.

6.2 METHODS OF INTERVENTION

Because it comprises several disease processes, there is no single method for the prevention of visual loss caused by glaucoma.

Acute angle closure glaucoma is a medical emergency, requiring prompt reduction in intraocular pressure and removal of the blockage of flow between the posterior and anterior chambers. The patient should receive a hyperosmotic agent, such as glycerol, and frequent topical miotics (e.g. pilocarpine 4%) until the angle is open. As soon as the eye is white and quiet, and the pressure normal, a peripheral iridectomy should be performed to prevent future attacks. To forestall an attack in the fellow eye, it should receive pilocarpine 1% twice a day until a peripheral iridectomy is performed later on.

Chronic open angle glaucoma cannot be prevented and its treatment is controversial. In most countries, drugs are used to lower pressure and to prevent visual loss from progressive destruction of the optic nerve. If medical therapy becomes ineffective, a surgical (filtering) procedure is performed. Such surgery is neither simple nor without risk, and the failure and complication rates can be appreciable. Unfortunately surgery is probably the only means of therapy applicable to developing countries, where the cost of drugs is prohibitive, and the close follow-up and supervision required for adjustment of drug type and dosage unavailable.

6.3 ACTION AT VARIOUS LEVELS

PRIMARY LEVEL

All primary health care workers should be able to recognize that an acute red eye, with reduced vision or pain or corneal clouding or dilated pupil requires immediate referral.

There is little the primary health care worker can do to identify patients with early open angle glaucoma. He should recognize the need, however, for referring any patient with decreased acuity, particularly when unilateral, and any patient with relatively fixed, dilated or asymetric pupils.

SECONDARY LEVEL

Personnel at the secondary level should be capable of differentiating the various causes of red eye and providing appropriate medical therapy. Whenever possible, they should have available both pilocarpine and oral hyperosmotic agents, such as glycerol, to treat angle closure. Depending upon their degree of training in ophthalmic disease, secondary level personnel may perform peripheral iridectomies. Otherwise these operations should be performed at the tertiary level.

For chronic open angle glaucoma, the challenge at the secondary level is case detection. Cases should then be referred to the tertiary level for evaluation and filtering surgery if needed. Following successful surgery, the patient should return to the secondary level worker for periodic evaluation and re-referral if the pressure should again begin to rise.

TERTIARY LEVEL

Depending upon the quality and relative availability of secondary and tertiary services, tertiary personnel may be required to perform peripheral iridectomies. Because of their superior training and facilities, they are best equipped for carrying out filtering surgery and managing its early postoperative complications.

6.4 ORGANIZATIONAL ASPECTS

TRAINING

Primary eye care workers should have a simple knowledge of the structure of the eyeball. They should receive instruction in the recognition and need for immediate referral of patients with red eyes and decreased vision or pain.

At a minimum, personnel at the secondary level should be familiar with the diagnosis and medical management of acute angle closure glaucoma. In some instances they may be trained to perform peripheral iridectomies. They should also be capable of performing tonometry, and examining the optic nerve head and visual fields to diagnose chronic open angle glaucoma.

Personnel at the tertiary level should be capable, in addition, of examining the anterior chamber angle and of managing chronic open angle glaucoma medically and surgically.

SUMMARY

Blindness is a major health problem, particularly in developing countries where the number of blind is 10 to 40 times higher than in industrialized countries. Much of this excessive blindness is caused by infections, malnutrition or cataract, and can be easily prevented or cured. The critical step is the incorporation of blindness prevention activities as an integral part of primary health care. The development of eye care services at the secondary and tertiary levels should be in harmony with the growth of primary eye care.

A national programme for prevention of blindness provides the coordination of activities at all levels. National programmes can also ensure that there is an appropriate and efficient utilization of resources. It is particularly important to provide repeated short training courses for personnel at the primary health care level. Moreover, the development of primary eye care ensures that secondary and tertiary facilities are used appropriately and efficiently.

Although effective methods have been developed to deal with some major blinding disorders (trachoma, blinding malnutrition, cataract and onchocerciasis), the methods of dealing with other problems, such as glaucoma and ocular trauma, are still evolving rapidly in the context of blindness prevention programmes. There is a great need for applied research in all these specific diseases to improve the effectiveness of blindness control activities. Such activities, however, should be directed towards the various aspects of blindness as such, and not just concentrate on certain easily identified problems.

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TABLE 1

CATEGORIES OF VISUAL IMPAIRMENT ADAPTED FROM THE INTERNATIONAL CLASSIFICATION OF DISEASES, NINTH (1975) REVISION

	Category of visual impairment[a]	Visual acuity[b] with best possible correction	
		Maximum less than	Minimum equal to or better than
Low vision	1	6/18 20/70 3/10 (0.3)	6/60 20/200 1/10 (0.1)
Low vision	2	6/60 20/200 1/10 (0.1)	3/60 (finger counting at 3 metres) 20/400 1/20 (0.05)
Blindness	3	3/60 (finger counting at 3 metres) 20/400 1/20 (0.05)	1/60 (finger counting at 1 metre) 5/300 (20/1200) 1/50 (0.02)
Blindness	4	1/60 (finger counting at 1 metre) 5/300 (20/1200) 1/50 (0.02)	Light perception
Blindness	5	No light perception	
	9	Undetermined or unspecified	

[a] If the extent of the visual field is taken into account, patients with a visual field radius no greater than 10° but greater than 5° around central fixation should be placed in category 3 and patients with a field no greater than 5° around central fixation should be placed in category 4, even if the central acuity is not impaired.

[b] For the first four categories of visual impairment, the different lines of figures in each box of the visual acuity columns represent the same level of acuity expressed according to different notations. The first line gives the notation used with the Snellen 6-metre scale (and, where applicable, the corresponding ability to count extended fingers at a set distance); the second line gives the equivalent notation used with the 20-foot scale; the third line gives the decimal notation.

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