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**SCIENTIFIC MEETING ON  
REHABILITATION IN LEPROSY**

**Vellore, Madras State, India  
21-29 November 1960**

**Report**

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**WORLD HEALTH ORGANIZATION**

**GENEVA**

1961



## SCIENTIFIC MEETING ON REHABILITATION IN LEPROSY

### Report

#### INTRODUCTION

The Scientific Meeting on Rehabilitation in Leprosy was held at Vellore, Madras State, India, from 21 to 29 November 1960.<sup>1</sup>

This meeting was sponsored by the World Health Organization, the Leonard Wood Memorial and the International Society for Rehabilitation of the Disabled, with assistance from the National Institute of Neurology and Blindness of the United States Public Health Service, the Bureau of Medicine and Surgery of the United States Navy, and the Christian Medical College, Vellore.

For the first three days the sessions were held at the Schieffelin Leprosy Research Sanatorium, Karigiri, where patients with typical varieties of deformity were available for demonstration and examination. The later sessions were held at the Christian Medical College, Vellore. Visits were paid to the Christian Medical College Hospital for demonstrations of surgical and physiotherapeutic procedures and to the Christian Medical College Rehabilitation Centre to study the re-education and vocational training services.

At the first session Dr C. K. Job, Superintendent of the Schieffelin Leprosy Research Sanatorium, welcomed the participants. Dr Gay Prieto and Dr Bland, on behalf of the Director-General of the World Health Organization, Dr Doull for the Leonard Wood Memorial, and Dr Itoh for the International Society for Rehabilitation of the Disabled thanked the Government of India for its permission, and the Council of the Christian Medical College for its kind invitation, to hold the Scientific Meeting in Vellore.

For all the arrangements made and for the hospitality given, the sponsors of and participants in this meeting are sincerely grateful to the staff of the

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<sup>1</sup> For list of participants, see Annex 3.

Christian Medical College and the Schieffelin Leprosy Research Sanatorium, as well as to their families.

The participants elected Dr J. A. Doull Chairman of the meeting and Dr D. C. Riordan and Dr R. V. Wardekar, Rapporteurs.

The Chairman defined the objectives of the meeting as the following :

(1) To outline the existing knowledge of the etiology, prevention and treatment of disablement found in patients with leprosy ;

(2) To advise how available knowledge could best be applied in leprosy control, treatment and rehabilitation programmes ; and

(3) To recommend what further research studies should be undertaken. In reporting the findings of the meeting, it would be necessary to indicate the size and extent of the problem, to suggest the optimum services needed and to indicate possible measures applicable in countries which, because of limited resources, cannot provide the optimum.

### 1. APPROACH TO THE PROBLEM

Some of the participants in the Scientific Meeting had little or no previous experience of leprosy, but were experts in various scientific fields pertaining to deformities and disabilities similar to those that afflict leprosy patients.

As the meeting progressed, two things became increasingly evident. One was the importance of the advances recently achieved in the field of leprosy rehabilitation by scientists whose prime interests and experience had been in different but related fields. The second was general surprise at the fact that so many problems in the pathology and treatment of leprosy deformities had not yet been solved, whereas closely similar problems had been or were being solved for many other diseases by the use of techniques already known and in common use in medical colleges and other research centres.

Perhaps the strongest recommendation made by this Scientific Meeting was that leprosy research should no longer be carried out merely in institutions confined to leprosy and by leprosy specialists who could not have the assistance of basic scientists and experts in other fields. It was felt that much more rapid progress in rehabilitation could be made if leprosy were studied and treated along with other diseases in centres where a wide range of medical scientists would be available. It would also be important to enlist the help of national and international agencies with experience in mobilizing public and private resources to overcome the effects of other crippling diseases.

## 2. EXTENT OF THE PROBLEM

### 2.1 Present knowledge

A reliable estimate of the prevalence of leprosy is impossible from the data available at this time ; nevertheless a world total of ten million cases can be accepted. Fewer than 5% can be accommodated in existing institutions ; the vast majority are living in their own homes, and probably not more than 20% are receiving treatment of any kind.

The estimate given in the second report of the WHO Expert Committee on Leprosy<sup>1</sup> that about 25% of all leprosy patients have some degree of disability is undoubtedly conservative, because in many surveys anaesthesia of the hands and feet, which constitutes a severe disability, has not been recorded except when accompanied by deformity. The frequency of disablement places a heavy financial burden on society, because a great number of leprosy patients become incapacitated for life. In spite of the world-wide awareness of this problem, it has been impossible so far to obtain accurate information regarding the frequency of disability resulting from leprosy.

The difficulty of obtaining reliable information on this subject, and especially data permitting comparisons of different geographical areas, was stressed in 1959 in reports issued both by WHO and by the Leonard Wood Memorial. Until the conditions that constitute disability are clearly defined and uniform standards established, comparisons between geographical areas will be of limited value.

### 2.2 Recommended action

The WHO Expert Committee on Leprosy, in its second report, proposed a classification for the grading of disability in leprosy patients<sup>2</sup> (see Annex 1). The Scientific Meeting carefully reviewed this classification and recommended its adoption for prevalence studies.

The meeting also recognized that, in addition to the need for a clearly defined standard for the grading of disability, there were other considerations which, if not taken into account, might render any comparison of doubtful validity. These are :

- (1) The age, sex and occupation of the patients.
- (2) The type and duration of the disease.
- (3) Ethnic and climatic differences.

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1960, 189, 21

<sup>2</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1960, 189, 22

The following methods were suggested for obtaining data on the frequency of disability in leprosy patients :

- (1) The sending of questionnaires to governments and to existing leprosy services, both institutional and out-patient.
- (2) The examination of representative groups of in-patients and out-patients of various countries.
- (3) Leprosy surveys of representative samples of entire populations in certain areas.

The disabilities should be graded as suggested in the second report of the WHO Expert Committee. For reports in connexion with (2) and (3) above, it was recommended that individual forms or cards showing the grade of disability should give, in addition, the following information :

- (1) Date of report.
- (2) Patient's age or date of birth.
- (3) Sex and occupation.
- (4) Type of disease (Madrid Classification, 1953).
- (5) Date when first signs were observed.
- (6) Date of commencement of anti-leprosy therapy, preparation given, and approximate amount to date of report.

### **2.3 Recommendations for research**

The following studies were recommended :

- (1) In addition to prevalence surveys, detailed surveys in certain areas to analyse not only the prevalence but the mode and time of onset of deformities and disabilities and their relationship to the stage of the disease and its treatment, as well as to occupation at the time of onset. Such surveys should be carried out by a team of specialists with trained helpers, using a detailed form of examination.
- (2) Evaluation of the effectiveness of drug therapy in the prevention or limitation of nerve damage and its sequelae. An adequately controlled study of this should be made.
- (3) Further research to determine the relative proportions of disablement caused by trauma and pyogenic infection, by specific leprosy invasion of the bone and by the non-specific process which follows nerve destruction. Only a beginning has been made on these subjects, and much can be learned by clinical observation supplemented by X-ray and histological studies.

### 3. NERVE INVOLVEMENT

#### 3.1 Nerve trunks

It was noted that nerve involvement in leprosy occurs: (a) in skin patches which may be found anywhere on the body and in which it causes superficial loss of sensation, and (b) in some mixed nerve trunks at certain definite sites of predilection in the limbs and face. Most of the serious disabilities in leprosy are secondary to the involvement of these important nerves.

The Scientific Meeting considered, therefore, that there is urgent need for a better understanding of the etiology and pathology of this nerve trunk involvement and of factors that may be used to minimize the resulting paralyses.

The nerves involved are:

- (1) Ulnar nerve, near the elbow.
- (2) Median nerve, near the wrist.
- (3) Lateral popliteal nerve, near the knee.
- (4) Posterior tibial nerve, near the ankle.
- (5) Branches of the facial nerve, especially at the zygoma.
- (6) Radial nerve, near the elbow.

Common to most of these sites of involvement are:

- (1) A superficial position.
- (2) Liability to trauma and pressure.
- (3) Proximity to bones and tendons.
- (4) Tendency to stretch on movement of joints.
- (5) Fibrous bands and tunnels distal to point of involvement.
- (6) Temperature lower than body temperature.

It was noted also that involvement at these sites is usually associated with a swelling of the nerve and that there is evidence to suggest that the ischaemia, which is secondary to the swelling, may be the immediate factor precipitating paralysis. This swelling may occur in all forms of leprosy.

With the present state of knowledge the Scientific Meeting recommended two practical measures for the prevention of nerve-trunk damage. These were the splinting of the affected limb and/or the use of a corticosteroid during acute reaction.

### 3.2 Nerve fibres

As a result of the use of special nerve-staining techniques and electron microscopy to examine biopsies, taken either by scientists in field expeditions or by trained personnel in well-equipped centres where reliable information is obtainable, it has already been possible to demonstrate the following facts :

(1) That in leprosy patients without loss of cutaneous sensibility (even when tested by the most refined methods at present available), up to 25% of the nerve fibres in the skin may be undergoing degenerative and regenerative changes and/or those changes associated with ischaemia.

(2) That in all cases of leprosy so far examined neural changes in excess of those found in normal subjects had been detected.

(3) That in certain cases of leprosy although no bacilli could be found in the skin, they were found in the nerve serving the area of skin involved.

(4) That, as shown by electron microscopy, in certain cases of leprosy the basement membrane related to the Schwann cells, melanocytes, and basal layer of epidermal cells was grossly thickened.

(5) That leprosy cases in which the deformities were most severe, the nerve fibres appeared to have been virtually destroyed—possibly by some sort of antibody-antigen reaction.

### 3.3 Deformity of hands and feet

At the Scientific Meeting the hands and feet of a large number of patients were examined, both before and during treatment by physiotherapy and reconstructive surgery. A number of patients who had been treated up to ten years previously by various operative procedures also had been called for presentation. Participants also examined follow-up studies of several hundreds of post-operative patients, and noted the methods by which the records were kept and analysed.

The Scientific Meeting was unanimous in the opinion that it has now been established that standard methods of physiotherapy and reconstructive surgery are applicable to leprosy patients, and that the results of such treatment are at least as good as those following similar treatment for other paralysing diseases. It was also apparent that, with suitable care by the patient, the results of surgical reconstruction tend to improve rather than to deteriorate with time.

Because the paralysis of leprosy is so well defined and predictable in its extent, the use of a small number of tried and proven operative procedures can restore severely disabled hands both to normal appearance and to activity, so that manual trades may be carried out with safety and dexterity.

The implications of these findings should be made known to all qualified surgeons and physiotherapists working in leprosy endemic areas in order that reconstructive programmes may be taken up and the work carried out along with that on other diseases.

Because both physiotherapy and reconstructive surgery should be undertaken only by those fully trained in these special fields, a detailed account of the scope of this work is not included in this report.

The following is a summary of the scope of treatment of paralytic deformities of the hand and foot.

### **Deformity Patterns and Type in Hand and Foot**

#### **Section I. Hand**

##### *A. Primary deformities*

There are two ways in which leprosy causes direct deformity to the hand. The first is by paralysing the motor nerves. This results in claw hand and in loss of abduction and opposition of the thumb from intrinsic paralysis. Rarely, the radial nerve may also be paralysed, giving rise to wrist drop. Secondly, the hand itself may be directly damaged by infiltration of its tissue during phases of reaction. In such cases, the skin and the underlying subcutaneous tissue may become first inflamed and later bound down and contracted by scar tissue, limiting the movement of the underlying joint capsules and superficial tendons. Fortunately, only the very superficial joints and tendons are affected. Bones also may be invaded by *Mycobacterium leprae* (see section 5.1.1) and undergo softening, followed later by recalcification if fracture has not occurred during the phase of fragility. All these direct invasions of the hand are, however, relatively rare. The most satisfactory treatment is to splint the hand in the position of function until the stage of reaction has passed. The splint may be removed at meal times, for washing, etc., but should not be left off completely so long as there is inflammation in the hand itself.

##### *B. Secondary deformities*

These are defined as deformities resulting from lack of treatment, neglect or injury to extremities which have motor or sensory nerve loss. These include (a) contractures of skin on the flexor aspect of paralysed fingers and thumb tip; (b) contracture of the thumb web; and (c) damage to and absorption of fingers due to wounds, to sepsis, to inability to grasp evenly with the entire surface of the hand, and to the use of excessive and unrealized force by anaesthetic fingers. Acute flexion of the fingers also exposes the knuckles to injury which may lead to sepsis at the interphalangeal joints.

### C. Treatment

#### (1) *Physiotherapy*

(a) *Oil massage.* The oil serves to lubricate dry anaesthetic skin; the massage helps to mobilize joints that have stiffened from disuse and to stimulate the blood supply.

(b) *Wax baths.* The wax softens the skin and stimulates sweat glands by acting as a hot pack.

(c) *Exercises.* After massage, the patient should be taught how to move his own fingers through the whole of their range of movement. He may do this by stabilizing his metacarpophalangeal joints in flexion using his other hand, and then actively extending his interphalangeal joints. He may also be taught to pull his fingers straight, using the utmost gentleness to avoid injury and subsequent scarring. The thumb web may also be prevented from contracting by frequent gentle pulling of the thumb away from the palm. In the case of mobile fingers, exercises should keep the hand supple and with a full range of movement. If there is already contracture in a flexed position, and if the patient cannot be relied upon to exercise constantly, splints should be used to maintain improvement between exercise sessions. In the case of severe contracture, splints will be needed but should be applied only by physiotherapists or trained auxiliaries. The most effective splint is a plaster-of-Paris cylinder, changed daily at exercise sessions. If staff is inadequate, the splints may be changed less frequently or may be made of plastic so that the patient himself can apply and re-apply them. The greatest care is necessary to avoid creating pressure sores.

#### (2) *Surgery*

The following operations have been extensively used and can be recommended for deformities of the hand:

(a) *For clawing of the fingers.* The many-tailed graft using the extensor carpi radialis (Brand), the extensor digiti minimi transfer (Fowler) and the sublimis transfer (Stiles-Bunnel).

(b) *For thumb paralysis.* The abductor-opponens replacement (Riordan) using the ring finger sublimis. When necessary the thumb web may be widened by the extended Z-plasty procedure.

(c) *For radial paralysis.* Wrist fusion and replacement of the extensors, using the flexor carpi radialis or the pronator teres.

(d) *For gross irreversible contracture.* Anterior skin grafting and interphalangeal arthrodesis.

## Section II. Foot

Involvement of the lateral popliteal nerve results in drop foot, causing a high stepping gait. Paralysis of the posterior tibial nerve in varying degrees is frequently seen. It is usually associated with clawing of the toes. Secondary deformity is mainly that resulting from damage to the tip and knuckle of claw toes and ulceration of the lateral border of the foot in cases of inversion. Contracture of the tendo achillis is rarely seen and is confined to those cases where the patient has been recumbent for long periods.

Trophic ulceration is discussed in section 4.

### *Treatment*

(1) *Drop foot* is treated by transfer of the tibialis posterior tendon to the front of the leg, so that it acts on the insertions of the tibialis anterior, the digital extensors and the peronei.

(2) *Claw toes* are treated either by dorsal transfer of the flexor tendon or by interphalangeal arthrodesis, depending on the degree of deformity.

(3) *Plantar ulcers*. Conservative treatment of plantar ulcers is discussed in section 4.7. The object of surgical intervention is usually to provide a better balance to the foot, to make it truly plantigrade, and to ensure satisfactory soft tissue pads below weight-bearing bones. For this purpose, parts of bone may need to be removed if they project ventrally or distally, causing localized pressure points. Soft tissue must be conserved as far as possible.

## 3.4 Recommendations for research

### 3.4.1 *Basic research*

The following studies were recommended as matters of priority :

(1) Biopsies of skin and nerve from contacts (both lepromin negative and positive) and from patients with different forms of leprosy to be examined by electron microscopy and the thickness of the basement membrane related to Schwann cells determined. Silver-stained control sections also to be made in every case.

(2) Attempts using the fluorescent antibody technique to examine nerves in animals following sensitization to various fractions of peripheral nerves obtained from a host of the same and different species.

(3) Attempts using the fluorescent antibody technique to examine biopsies from volunteers following sensitization with killed *Myco. leprae* (isolated from tissue by new techniques) injected directly into the nerve.

(4) *Studies to answer the following questions :*

(a) Is the arrangement of fibres in the facial nerve as it passes through the facial canal such that the upper two branches are more peripheral, or somehow arranged so that they are more susceptible to the effects of trauma during acute swelling ?

(b) Complete paralysis of one side of the face is very common in some countries, while in others paralysis of the frontalis and orbicularis oculi is usually seen. Can we obtain autopsy material which will more clearly define the exact nature and locus of facial nerve involvement ? Particular attention should be paid in this material to the greater superficial petrosal nerve, since the question of taste alteration is unknown.

#### 3.4.2 *Clinical research*

The following studies were recommended :

(1) A clinical evaluation of enzymes such as chymotrypsin, since there is some evidence that their systematic administration during the course of a reaction may be beneficial. In addition to the use of the drug without surgical intervention, clinical evaluation of its effectiveness could be obtained in the following way. Wherever bilaterally symmetrical ulnar or median lesions appear and there are indications for either ulnar nerve transplant or carpal tunnel release, chymotrypsin, for example, could be administered and only one of the involved nerves operated upon. At the same time skin and cutaneous nerve biopsies should be obtained.

(2) *Studies to answer the following questions :*

(a) Are there significant ethnic or geographical differences in the rate of appearance of various nerve trunk lesions ?

(b) Is there a greater incidence of upper facial paralysis among persons who rest their faces on a hard surface in sleep ?

(c) Does the wearing of shoes affect the rate of appearance of posterior tibial paralysis ?

(d) Is the squatting position, common in India and Africa, related to peroneal nerve pathology ?

(e) It is reported that 5% of people have ulnar nerves which are free to move in and out of the olecranon groove. Have such anomalous nerves been seen in patients with leprosy, and have they been spared or are they relatively less involved ?

The answers to these questions might shed some light on the relationship between trauma and nerve trunk pathology.

(3) *Studies on the facial nerve.* Where there is involvement of the upper branches of the facial nerve, consideration should be given to dividing the

tough fibrous investments of the nerve as it crosses the zygoma. Facial-accessory anastomosis should be given a trial for total facial paralysis.

(4) *Studies on the ulnar nerve.* It was agreed that ulnar nerve transposition anterior to the medial epicondyle and deep to the flexor mass as far lateral as the median nerve should be considered at the earliest sign of palpable enlargement of the trunk, of pain or of weakness. Where competent surgical help is not available, consideration should be given to simple unroofing of the olecranon groove or division of the tough fibrous band crossing the nerve where it leaves the olecranon groove. In the rare instances where solitary lesions appear in major nerve trunks, consideration should be given to excision of the lesion, as soon as it is quiescent, with end-to-end anastomosis.

(5) *Studies on the median nerve.* Carpal tunnel release should be considered at the earliest sign of thickening, pain or weakness.

#### 4. TROPHIC ULCERATION

The lesion that presents the major problem resulting from trophic disturbances in leprosy is that which is seen clinically as a plantar ulcer of the foot. It was agreed that this is an expression of nerve damage and is not a specific leprosy lesion.

The lesion commonly results from tissue damage in the foot, with a sensory deficit which leads to necrosis of deep tissue and finally ulceration and which occurs in well-defined areas of the sole of the foot.

##### 4.1 Sites of plantar damage

There is general agreement that the sites of plantar damage in the insensitive but undeformed foot are, in order of frequency, related to the following bony prominences :

- (1) The metatarsal heads, especially I and II.
- (2) The tubercle at the base of metatarsal V.
- (3) The calcaneal tubercles at the heel.
- (4) The head of the proximal phalanx of the great toe.
- (5) The terminal phalanges of the toes.

##### 4.2 Nature of plantar damage

The tissue damage is manifested by the appearance of sterile necrotic material in the soft tissues adjacent to the plantar surface of the associated bony prominence. This tracks to the surface and is first visible as a blister

or bleb ; it then breaks through the skin and initiates the ulcer. Sometimes the primary damage is to the skin.

#### 4.3 Neuropathic state of the trophic foot

Although the foot with an ulcer usually demonstrates complete anaesthesia or partial sensory dissociation, there is no present knowledge of the sensory state of the foot at the moment of initial plantar damage, and the acquisition of this knowledge is a pressing need for research.

#### 4.4 Cause of plantar damage

Given a sensory deficit (which is not yet clearly defined), the reason for the localized appearance of necrosis has been studied. It was the general opinion that, of the varying theories of causation, there are strong indications that the major cause is the mechanical effect of the shearing strain and abnormal pressure that occurs during walking on a neuropathic foot. Attention was directed to the observation that the sites of plantar damage coincide with the points of heel impact, of flexion across the walking sole, and of push-off at the end of the stride.

The lack of sensation also allows patients to walk on sharp objects and to use ill-fitting footwear causing blisters and breaks in the skin without pain. Such injuries do not cause plantar ulcers unless the patient continues to walk on them before they heal. There is no evidence that the lesion is due to any local specific effects of the leprosy bacillus.

#### 4.5 Natural history of plantar damage

In clinical practice, the lesion appears in the following sequence :

(1) *The initial lesion or "pre-ulcerative stage"*. At this stage the foot presents a small, well-defined area which is tender to deep pressure and locally oedematous. The oedema is recognized as a small boggy swelling and by the splaying of the toes adjacent to that of the affected metatarsal. The patient complains of burning discomfort, especially at night in bed, but does not usually present a noticeable limp.

(2) *The "necrosis blister"*. As the damage proceeds, the necrotic material increases in volume and may be seen as a soft, fluctuant swelling, which contains sterile, necrotic, sometimes haemorrhagic fluid. This may appear immediately superficial to the area of initial damage but frequently tracks to the edge of the hard skin of the sole. The patient now limps and may ask for treatment ; he may be thought to have sustained a burn of the foot.

(3) *The initial ulcer*. Untreated or unprotected, the necrotic material finally breaks through the skin, and an ulcer is produced.

This first ulcer is a crucial stage in the development of the lesion and should be avoided at all costs. It opens the way to infection of the deep tissues, to bone and joint; the resulting infection disorganizes the special arrangement of the soft tissues and skin of the sole, and there is the danger of infection of vascular and lymphatic channels, with permanent damage to the local nutrition of tissues.

The initial ulcer may be unperceived by the patient and may not be reported to the medical attendant. If treatment by resting the foot is instituted, the ulcer heals within a few weeks in response to a variety of widely diverse methods of local treatment, the simplest being rest in bed with a plain gauze dressing.

(4) *The recurrent ulcer.* The recurrence of a plantar ulcer indicates that the lesion is likely to progress, if uncontrolled, to the complete disorganization of the foot. Unfortunately, with walking, recurrence is the rule rather than the exception, though there are cases where spontaneous healing of the initial ulcer is never followed by another ulcer.

#### **4.6 Association with neuropathic (Charcot) joint**

Attention is drawn to the frequent association of plantar damage (as described above) with the lesion commonly known as the "Charcot joint". The two lesions occur frequently in the same foot and are expressions of the same sensory deficit. Care must be taken to differentiate this indolent swelling of the mid-tarsal, tarsometatarsal or ankle region from infection of the joint through the ulcer that commonly co-exists.

All cases of plantar ulcer should be carefully inspected for hot swollen ankle and foot. Such cases should on no account be put in a walking plaster.

#### **4.7 Management of plantar damage in the neuropathic foot**

In the absence of any special limitations to the medical facilities available, the management of the plantar damage should be as follows:

(1) *The initial lesion and the "necrosis blister".* These will both subside in ten to twelve days if the foot is completely rested. When walking is resumed, further damage should be prevented by the use of rigid-sole footwear.

(2) *The initial ulcer.* This lesion can be treated at home, as long as the gravity of the occurrence is appreciated. The simplest treatment is bed-rest, but this will take four to five weeks. Equally effective is the use of rigid-sole footwear after a preliminary period in bed of three or four days, so that oedema can be reduced and secondary infection eradicated.

A common procedure is the use of a below-knee walking plaster cast on a wooden sole with rocker, or with a walking iron. The ulcer will heal within four to six weeks.

Healing should be followed at once by the provision of suitable footwear. There is general agreement that this footwear, to be effective, must include a rigid-sole with a rocker and a soft insole; the use of a moulded insole is also helpful, but can be dispensed with in the absence of special facilities.

(3) *The recurrent ulcer.* The recurrence of the ulcer during treatment, or the presence, at first clinical examination, of a large ulcer with obvious bone infection or extensive skin loss, is an indication of the need for special orthopaedic and plastic care. If at all possible, patients with those lesions should be referred to the attention of those specially trained in reconstructive surgery.

For the satisfactory treatment of severe recurrent and complicated ulcers, surgical intervention may sometimes be necessary. The Scientific Meeting recommended that qualified reconstructive surgeons should be urged to undertake this work and that, in their absence, only conservative treatment be attempted.

#### **4.8 Management of plantar damage in special circumstances**

In the absence of adequate surgical facilities, the following problems present themselves :

(1) In a region with only a few orthopaedic and plastic centres it is suggested that auxiliary workers be trained with the co-operation of orthopaedic, plastic and physiotherapeutic specialists. These specialists should be encouraged to give such training, and will be able to judge, according to the content of training given, the instructions to be issued as to the stage of ulcerative damage at which patients should be referred by the auxiliary for specialist care.

In orthopaedic and plastic units of general hospitals there should be facilities for admitting patients with these needs and for treating them as part of the routine activity of the centre concerned. In the present state of medical care and knowledge, there is no longer any justification for having special centres for these leprosy patients.

(2) In a region without any orthopaedic or plastic centre it must be realized that many advanced cases of plantar ulcer will be incurable and amputation may be the final outcome. However, attention must be drawn to the spectacular results that can be achieved by the intelligent and persistent use of plaster casts and rigid-sole footwear. In the absence of special orthopaedic services the importance of control of the pre-ulcerative lesion is pre-eminent. The objective should be to prevent the occurrence of the

initial ulcer. A practical step would be to initiate in a "pilot area" a complete system of foot inspection and control and to provide for treatment with plaster or special footwear (or both). In view of the rapid development of such lesions, there should be weekly inspection of a foot with a sensory deficit. A period of a year would make it possible to estimate the extent to which the local conditions would make this method of control possible. "Local conditions" include the reaction of the patients to such treatment, the reliability of the local paramedical personnel and the effectiveness of the treatment in the special circumstances of the area. A successful pilot experiment would make the wider use of the method acceptable and easier to propagate.

It is emphasized that if present knowledge were properly applied, plantar ulceration should never occur as a complication of leprosy.

## 5. BONE CHANGES AND ABSORPTION

### 5.1 Present knowledge

There are three main types of bone changes seen in leprosy :

- (1) Specific osteitis leprosa.
- (2) Non-specific bone absorption.
- (3) Osteoporosis.

#### 5.1.1 *Specific osteitis leprosa*

This has been seen in a small percentage of leprosy cases. Radiographs of the phalanges may show multiple areas of bone destruction with at first hazy and, later, clear-cut margins. Occasionally other superficial bones are involved. These specific bone lesions have often been seen in association with swollen painful fingers. In a few cases, bone biopsy from the site of these lesions has shown evidence of lepromatous granuloma in the bone. Cases have been seen to heal with sclerosis and thickening of the cortex after about one year of sulfone therapy.

#### 5.1.2 *Non-specific bone absorption*

Non-specific bone absorption is much more commonly seen in both types of leprosy. Such lesions occur in the bones of the fingers and toes, in the metatarsals and in the bones of the nasal area. Occasionally, the tarsus, carpus and metacarpals are involved.

The radiographic appearances of this absorption show at first a hazy destruction of cortex and trabeculae ; later, in a healing phase, these areas of destruction become clear-cut.

In the chronic state there may be a concentric type of absorption in which outer areas of the cortex are absorbed and new bone is laid down on the inner side; in this way phalanges and metatarsals eventually become tapered off to points with no reduction in bone density or thickness of cortex. This concentric absorption is seen more frequently in the foot than in the hand. In the tarsus and carpus there may be hazy destruction of trabeculae followed by collapse of bones that are subject to pressure.

In considering the pathogenesis of non-specific bone absorption, it was pointed out that such absorption is associated with several factors, the chief of which are nerve lesions, traumata and sepsis.

(1) *Nerve lesions.* Non-specific bone absorption of the type seen in leprosy also occurs in other conditions where there is a disease of the nervous system, such as diabetic neuropathy, spina-bifida, syringomyelia and congenital indifference to pain, and in conditions where there is no clinical evidence of sensory loss, such as scleroderma.

Even in the absence of a clinically detectable nerve lesion, there may be histopathological evidence of a diminution in the numbers of free nerve fibres in the skin. This may be associated with disorganization of the normal mechanism of tissue repair and replacement. These nerve lesions may be the basic cause of similar bone changes in the above varied conditions.

Nerve lesions alone will not cause bone absorption. For example, paraplegic patients who are protected from trauma will develop osteoporosis only; hands that are completely protected from any form of stress or strain, even in the presence of extensive nerve lesions, may suffer from wasting and osteoporosis from disuse but will suffer no bone absorption or loss of length; a protected contracted finger tip, even if anaesthetic, does not develop bone-absorptive changes.

Nerve lesions combined with factors of trauma, stress or infection may, however, produce bone absorption.

(2) *Minor trauma and stress.* Repeated minor traumata and stress in patients with no disease of the nervous system cause no bone absorption, because the system of tissue repair and replacement functions normally.

It must be clearly understood, however, that stresses that are not excessive for normal hands may be a hazard in cases with nerve lesions, for the following reasons:

(a) The stress that is safe when spread over a large area may be damaging if applied to a small area. Muscle imbalance with claw fingers tends to concentrate all hand force on the finger tips.

(b) Patients without sensation do not know how much strength they are applying, and commonly grasp very much harder than necessary.

(c) The subcutaneous scarring that results from a series of minor injuries to pulp tissues causes a fibrous replacement of these normally

vascular tissues and the development of foci of aseptic necrosis. These foci of aseptic necrosis may press on bones and cause small areas of bone absorption.

(3) *Sepsis*. In persons with no disease of the nervous system, ulceration and sepsis of the soft tissues cause only small areas of bone destruction or osteitis that usually heal with treatment.

Patients with clinical or subclinical sensory loss, however, tend to neglect minor wounds, and thus chronic ulcers develop, leading to bone absorption.

Only 50%-60% of digits with anaesthesia from leprosy develop bone-absorptive changes, but almost all digits with anaesthesia and ulceration develop such changes. Absorptive bone changes are not a progressive "neurotrophic bone atrophy"; if soft tissue infection and ulceration can be healed and kept healed and trauma prevented, the process of bone absorption will be arrested.

In joints where there is sensory loss, minimal trauma or infection may similarly cause extensive bone absorption and disorganization.

### 5.1.3 *Osteoporosis*

Osteoporotic changes are seen only in a small percentage of cases. Radiographs of these cases show, in the early stages, a reduction in the number of bony trabeculae in the cortex, and later a thinning of the inner layers of the cortex. These osteoporotic changes are associated either with local disuse due to pain, swelling or paralysis, or with general disuse in old age or debility. In the absence of pain sensation, bones that would normally show osteoporosis in the presence of a painful infection show the concentric type of absorption, with retention of the normal thickness and density of cortex.

## 5.2 Recommended treatment of bone lesions in leprosy

(1) *Specific osteitis leprosa*. This can be healed completely and deformity can be prevented by immobilization of the involved part in a functional position during periods of pain and swelling. Check radiographs should be taken every four months, and sulfone and other therapy should be continued until radiographic signs of bone recalcification are seen.

(2) *Non-specific bone absorption of fingers*. Such absorption can be arrested by preventing minor trauma, ulcers, etc., and by paying immediate attention to any minor cut or scratch on the fingers. Relapse and further absorption can be prevented by re-education of the patient in the use of his hands in a suitable occupation.

(3) *Non-specific bone absorption in the feet*. This may be arrested by healing plantar ulcers by rest in bed, walking plaster, etc. Recurrence of

ulcers and further bone absorption can be prevented by rigid-sole shoes, and by careful education of the patient in the care of his feet. Metatarsectomy is not advised.

(4) *Neuropathic or "Charcot" ankle and wrist.* This condition can be recognized by early detection of swelling and later by abnormal mobility and crepitus. All anaesthetic feet should be regularly inspected and palpated, and, if possible, radiographs of the ankle and tarsus should be taken every four months. The only effective treatment for neuropathic joints is early fusion. In the absence of facilities for surgery a protective caliper may be used to slow down further destruction.

### 5.3 Recommendations for research

Further studies should be carried out on :

(1) The cause of specific bone destruction. (This should be done by keeping careful records of any lepra reactions or infiltrations in the fingers, and by correlating such findings with radiographs of each finger and with biopsies of the affected areas of bone.)

(2) Details of the nerve supply to the phalanges and the nerve fibrils in the bone.

(3) The nature of the mechanism of bone repair and replacement, with special reference to denervation.

(4) The effects of nerve damage of varying degrees on the digits of experimental animals (by serial radiographs and by making histopathological studies).

(5) Details of the arterial and venous supply to the phalanges, with particular reference to the function of the "nutrient foramina" in phalanges.

(6) In long-standing contractures of the fingers, the significance of areas of bone erosion on the anterior aspects of the cortex of proximal phalanges to be investigated by correlation with the results of physiotherapy.

(7) The nature of the bone changes in the neurotrophic foot, to be studied by correlating serial radiographs with clinical and bone-biopsy findings in a series of cases. The true incidence of these lesions should be ascertained. (See also section 2.3, paragraphs (2) and (3).)

### 5.4 Recommended educational measures

A publication illustrating the various radiographic appearances of bones in leprosy should be prepared. Details of case histories should be given along with prints of radiographs.

## 6. DEFORMITIES OF THE FACE

Most facial deformities result from lepromatous leprosy, except for lagophthalmos, which is more common in the tuberculoid type.

Mucous-membrane involvement in the nose is an early and important feature of the disease and is the primary factor responsible for collapse of the nose. The ulceration of the mucous membrane leads to exposure necrosis of the underlying cartilage and bone of the nose. There does not appear to be any direct invasion of cartilage and bone. The evidence for this view is at present circumstantial. The alar cartilages, which are covered by skin on both surfaces, are rarely destroyed, even in the most advanced cases. Septal cartilage and the bony nasal spur of the maxilla are the first parts of the nasal framework to be destroyed, probably because they are covered by mucous membranes on both their surfaces. The sequence of deformity is mucous-membrane ulceration, silent perforation of the septum, total destruction of the septum and nasal spur, and finally absorption of the nasal bone.

Lagophthalmos is caused by paralysis of the zygomatic branch of the facial nerve. It results in inability to close the eyelid for protection against foreign bodies and in paralytic ectropion of the lower lid, resulting in constant exposure of the cornea and conjunctiva to the drying effects of wind and dust. This leads to conjunctivitis, desquamation, ulceration and perforation of the cornea, and finally to opacity and loss of sight.

The loss of eyebrows results from lepromatous destruction of the hair follicles. There may be partial regeneration if the disease is arrested in time.

Lepromatous disease appears to destroy the elasticity of the skin, so that after resolution of the disease the skin fails to return to its normal state. Typical wrinkling and sagging of the skin occur, leading to the condition known as "sagging face".

It is significant that the cartilage of the ear does not suffer damage in spite of heavy lepromatous infiltration of the skin of the ear. "Hanging lobule" develops as the result of sagging. The multiplicity of small nodules along the helix gives a curious rat-bitten appearance.

### 6.1 Treatment

Early detection and early treatment of leprosy may prevent the onset of these deformities. Because there is no loss of skin, all these deformities lend themselves readily to reconstructive surgery, with dramatic improvement. This is of the utmost importance for the social rehabilitation of the patient. It should be recognized that the operative procedures can be successfully performed only in a centre properly staffed and equipped for reconstructive surgery.

Where such centres already exist, they should be encouraged to undertake the reconstructive work of leprosy. Adequate facilities should be accorded for this purpose, and priority given to those centres which have already made a start in this work. It is desirable that work of this kind be undertaken by hospitals and medical schools in endemic areas with a view to making students and doctors conscious of the problems of leprosy and of the value of modern treatment.

## 6.2 Routine plastic procedures

### (1) *Nose*

- (a) Simple bone graft, in the very early cases only.
- (b) Post-nasal epithelial inlay—this is a standard procedure for most cases of nasal collapse. The operation consists of replacing the lost mucous-membrane lining by means of a skin graft. This can be followed by dental prosthesis, or retrograde bone graft to supply the support.
- (c) Total rhinoplasty in rare cases of total destruction.

### (2) *Lagophthalmos*

- (a) Tarsorrhaphy—this is satisfactory as an emergency procedure to prevent exposure keratitis and to save the eye.
- (b) Static sling.
- (c) Temporalis musculo-fascial sling—this is the most satisfactory procedure because the result is that the eye can be closed and opened at will. Such an operation should only be performed by a surgeon trained in reconstructive surgery.

### (3) *Eyebrow*

- (a) Temporary artery island scalp flap.
- (b) Scalp pedicle flap.
- (c) Free graft of scalp.

### (4) *Sagging face*

- (a) Face lift.
- (b) Trimming of ear lobules.

## 6.3 Recommendations for research

Studies are suggested on the following :

- (1) Incidence of the various deformities as compared with the total leprosy population in the different countries.

(2) Incidence of keratitis in lepromatous leprosy with or without lagophthalmos, and its relation to corneal sensation.

(3) The cause of the loss of skin elasticity, with particular reference to study of elastic, pre-collagen and collagen fibres in leprosy skin.

(4) The reason for the apparently low prevalence of keloid formation and hypertrophic scars in leprosy patients.

(5) The reason why hair loss characteristically appears in certain areas of the body.

(6) The mechanism of nose collapse.

(7) Evaluation of present and future operative procedures and techniques used in reconstruction, with a view to establishing standard procedures which can be recommended for general use. This should be carried out in a plastic surgery unit which is undertaking this work. Facilities for accurate records, a photography department and follow-up should be provided.

## 7. OCULAR DAMAGE

### 7.1 Present knowledge

Blindness, a serious disablement for the average person, is a disaster to the leprosy victim who has lost sensation in his hands and feet.

Although figures of the incidence of ocular involvement vary from different sources, there is full agreement that they are common enough to present a serious problem.

The important ocular lesions in leprosy are :

(1) Damage to the globe by drying and trauma due to lid paralysis (lagophthalmos), which may range from simple desquamation of corneal epithelium to severe ulceration and intra-ocular infection. It is more common in tuberculoid cases.

(2) In the lepromatous type, direct invasion of the tissues of the anterior segment of the eye by *Myco. leprae*, with the formation of granulation tissue. This may result in any or all of the following common conditions : loss of corneal sensation, keratitis, iritis and iridocyclitis with inflammation of the sclera in the ciliary area.

(3) Allergic manifestations in lepromatous cases in reaction, generally involving the sclera, episcleral tissues, iris and ciliary body.

The conditions most liable to lead to blindness in leprosy are severe lagophthalmos, particularly in the presence of corneal insensibility, and the iridokerato-scleral group of complications due to either direct lepromatous infiltration or allergy or both. Iritis is the commonest single cause of blindness in leprosy.

## 7.2 Recommended treatment

### 7.2.1 General: the value of sulfone therapy

Although we do not have enough statistical data to constitute proof, there is a strong impression that since the introduction of the sulfones the incidence of severe ocular damage in leprosy has decreased. Sulfone therapy must be given under supervision by workers who can recognize an allergic reaction and withhold the drug until the reaction is under control. It must also be stressed that general medical treatment does not eliminate the need for watchfulness and the early recognition and treatment of ocular lesions.

### 7.2.2 Local

#### (1) *Lagophthalmos*

(a) The ideal treatment for this condition is the temporalis transfer. This is not an operation to be attempted except by experienced surgeons.

(b) Tarsorrhaphy is a simple operation which will protect the cornea and preserve sight until such time as the temporalis transfer operation is available. Every doctor in charge of leprosy patients should be familiar with the technique.

(2) *Cases of corneal, scleral or iris involvement.* Broadly speaking, the local treatment of these conditions is the same. The two most important drugs are 1% atropine and the corticosteroids.

(a) *Atropine.* This is normally an urgent requirement. Some doctors are afraid of using this drug lest it precipitate an attack of glaucoma. It is unlikely that a case of leprosy with a painful red eye, reduced vision and a small pupil is anything but a case of iritis with or without its complications. If there is doubt, the matter can easily be settled by estimating the tension either by digital palpation or with a tonometer. If there is a secondary glaucoma showing itself as raised tension and a small pupil, a paracentesis should be done *and atropine given subsequently*. Such complicated cases must be referred as soon as possible to an ophthalmologist.

(b) *Corticosteroids.* These are valuable drugs. They can be given locally as drops, ointment or subconjunctival injection. Where an open corneal ulcer exists—shown by staining green with 1% fluorescein—cortisone should be given cautiously and only with an antibiotic.

## 7.3 Recommended action

### 7.3.1 In institutions

In view of the joint responsibility of leprologists and ophthalmologists in dealing with ocular leprosy, it would be advisable for all leprosy hospitals

to have the services of a trained ophthalmologist who can visit regularly, and for all ophthalmic hospitals in endemic areas to have facilities for treating leprosy patients.

In the event of an ophthalmologist's not being available, the physician in charge of a leprosy institution should spend some time, if possible, in an ophthalmic hospital, where he can get acquainted with the investigation and care of the eye in general. It is essential that he should master the simple technique of examining the eye with the help of a well-focused beam of light and a magnifying loupe. This equipment is not expensive, and with its help all gross pathology can be detected. For a research institution a slit-lamp microscope is essential.

Every patient coming under the care of a leprosy medical worker should have a preliminary examination, with the following findings recorded :

- (1) The vision of each eye tested separately.
- (2) The condition of the lids (lagophthalmos).
- (3) Redness of the eye.
- (4) The state of the cornea, including sensation.
- (5) The state of the pupil including its appearance one hour after 2% homatropine has been instilled.

Suitable treatment can then be instituted along the lines already suggested.

### 7.3.2 *In field areas*

Any paramedical worker can be trained in the use of a good torch to examine the eyes of each patient he undertakes to treat. With a simple five-point questionnaire to guide him, he will be able to recognize the danger signals of ocular involvement.

The meeting suggested the following five points :

- (1) Does the patient complain of burning, watering, pain, etc. ?
- (2) Can he close his eyes ?
- (3) Is the eye red ?
- (4) Is the cornea clear ?
- (5) Is the pupil mobile in each eye ?

Any cases showing abnormalities should be referred to a qualified medical worker.

If a patient presents redness, pain and an immobile pupil, the paramedical worker, before referring the case to the doctor (unless he can ensure that the patient sees one within twenty-four hours), should apply 4% homatropine until the pupil is dilated. Some paramedical workers are sufficiently

experienced and observant to be entrusted with the use of atropine to dilate the pupils. It is for the doctor in charge of that area to decide whether he can trust their judgment in this; he is ultimately responsible for any possible misuse of the drug.

### 7.3.3 Conclusion

It must be stressed that one cannot depend upon patients' reporting their symptoms. Many of them regard eye troubles as inevitable and not worth reporting. It is therefore most important to be constantly on the watch for complications and for all routine examinations of patients to include a brief check on the eyes. This takes only one minute of time but may save years of blindness for a patient.

## 7.4 Recommendations for research

The following research is suggested :

- (1) Studies to establish the pattern of ocular involvement in leprosy :
  - (a) What are the earliest manifestations ?
  - (b) Can these be found in contacts not showing any other evidence of the disease ? (Some work has already been done on this with varying results.)
- (2) An investigation into the extent to which the corneal nerves are involved in leprosy. At what stage of the disease ? What part does the loss of corneal sensation play in the development of keratitis ? Is it primary or secondary ? Is recovery of corneal sensation a proven fact, and if so, under what conditions ? Do the use of steroids favour its recovery ?
- (3) A search for some anti-leprosy drug which can be used topically or subconjunctivally in cases where the eye is heavily infected with *lepra bacillae* and is in danger of gross and irreversible damage.
- (4) Controlled studies of the cause of lagophthalmos development, its possible recovery and its treatment in the early stages by physiotherapy.
- (5) A study of the eye in :
  - (a) Exacerbation of lepromatous infiltration.
  - (b) Allergic reaction.
- (6) A comparative study of the long-term effects of corneal grafting.

## 8. RECOMMENDATIONS ON THE PROVISION OF REHABILITATION SERVICES

### 8.1 Definition of rehabilitation

In its second report, the Expert Committee on Leprosy defines "rehabilitation" as follows :

" By rehabilitation is meant the physical and mental restoration, as far as possible, of all treated patients to normal activity, so that they may be able to resume their place in the home, society, and industry. To achieve this, treatment of the physical disability is obviously necessary, but it must be accompanied by the education of the patient, his family and the public, so that not only can he take his normal place, but society will also be willing to accept him and assist in his complete rehabilitation." <sup>1</sup>

### 8.2 The problem of deformities in leprosy

The problem of deformities due to leprosy is not basically different from that of disablement from other causes ; the same principles of rehabilitation, of reconstructive surgery and of re-education are applicable. It is preferable, therefore, both socially and economically, that rehabilitation centres and services should provide for the treatment of all the physically disabled of the community. In special circumstances and in some localities, however, it may be necessary to provide services specifically for leprosy patients, but this is not the ideal.

Leprosy presents special problems because :

(1) The public is afraid of the deformities, thinking that they represent leprosy infections.

(2) Patients fear that deformities of the hands, face and feet are inevitable and cannot be prevented or cured.

(3) Ordinary employment and work may be either impossible or harmful to the patient with loss of sensation.

### 8.3 Rehabilitation programmes needed

To overcome the special difficulties, the following programmes are necessary :

(1) *Education of the medical profession and of the public*

Because widespread and deeply rooted prejudices with regard to leprosy form the greatest single barrier to rehabilitation, a wide educational and propaganda campaign needs to be organized to inform the public of the true facts of the disease. Emphasis should be placed on the fact that leprosy

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1960, **189**, 20

is curable and that residual deformities do not necessarily mean that the disease is still active.

Rehabilitation agencies, international and national, governmental and voluntary, should be urged to include leprosy patients in their future programmes. The experience of such agencies in combating prejudice concerning physical disability and in mobilizing professional and public co-operation can be a great asset in developing future leprosy programmes.

As long as the medical profession continues to treat leprosy separately from all other diseases, the public can hardly be expected to believe that it is not a "disease apart". It is therefore recommended that all health programmes should encourage the treatment of leprosy along with other diseases in general hospitals and dispensaries. Particular attention should be given to medical colleges so that medical students may become accustomed to see and to treat leprosy patients in the wards of their own hospitals. A new generation of medical men will then be able to lead public opinion in the right direction.

### *(2) Education on the prevention of deformities*

Prevention and rehabilitation programmes must be developed simultaneously. Prevention, treatment and rehabilitation are inseparable parts of the total programme to be developed.

Education to prevent deformity must be carried out in all leprosy control units and institutions. Rehabilitation begins when the disease is first diagnosed. Therefore, the doctor or paramedical worker in the field must help all patients to adjust themselves both to the limitations imposed by the disease and to the expectancy of a return to full and normal life. All leprosy units should be provided with posters and demonstration material. No special rehabilitation programme can be a substitute for this basic education given to the patient. The great majority of patients should complete their rehabilitation with no other outside help and without admission to any institution.

All physicians and field workers should be trained to look for signs of early damage and for sensory loss in limbs, and to advise patients how to prevent more severe damage. They should also select from the general mass of patients a few categories who may need the special care of the physiotherapist. Certain categories of patients may need and should have short periods of training at re-educational centres (Activities of Daily Living Training Centres) to learn methods of adjustment to deformity and disability.

### *(3) Correction of deformities*

#### *(a) Non-surgical*

A physiotherapy unit with a few beds for ulcer treatment, should be staffed by a physiotherapist, or in the absence of a physiotherapist by a

specially trained auxiliary worker to concentrate mainly on the care of patients with plantar ulcers and the correction of early deformities (see Annex 2).

(b) *Surgical*

Reconstructive surgical centres with an operating theatre and a trained surgeon for treatment of cases referred by physiotherapists are needed.

(4) *Re-employment services*

The following services are needed to complete the rehabilitation of patients :

- (a) Employment services to place patients in jobs.
- (b) Vocational training centres to train patients in new trades, which they can continue at home.
- (c) Sheltered workshop to provide continuing employment (not residence) for those who cannot be independent.
- (d) Settlement to provide a permanent home and work when both are necessary.

#### **8.4 Relating the programme to the general health services**

In considering the rehabilitation services to be provided along with any leprosy control and treatment programme, one has to take into account the standard of general health services in the area together with the problem of leprosy in that area.

(1) *Areas with adequate medical services and a low endemicity*

In such areas no special services are required ; existing rehabilitation services for all other diseases should be made available for disabled leprosy patients.

(2) *Areas where leprosy is endemic but resources of trained personnel are meagre*

The rehabilitation programme in these areas should be built up around a good surgical reconstructive unit. The staff of such a unit must contain at least one surgeon and one physiotherapist, and the unit may be based on an existing general hospital or leprosy institution. The training of personnel for the whole programme may be carried out by this unit. If suitable staff is not available locally, a team could be sent in, sponsored by an international organization to initiate the programme. Auxiliary leprosy workers should be so trained as to be able to teach patients simple

procedures for avoiding damage to limbs with sensory loss, and for maintaining mobility of parietic fingers. They should also be able to provide suitable treatment for plantar ulcers of the foot (see Annex 2).

- (3) *Areas in which leprosy is endemic and the existing medical services are not yet totally adequate*

In these areas special services have to be provided, and the recommendations which follow in this report are applicable in part or in whole.

### **8.5 Training programmes for areas with limited health services**

The greatest need is neither for buildings nor for equipment, but for trained personnel.

The following kinds of workers need training :

- (1) Every leprosy worker (who should understand the basic principles of rehabilitation).
- (2) Auxiliaries, in physiotherapeutic methods.
- (3) Surgeons, in reconstructive techniques.
- (4) Social workers, as placement officers and for liaison with homes and villages, and as vocational instructors, in the special methods of dealing with the limitations imposed by deformity.

#### *8.5.1 Basic training for all leprosy workers*

The most important single need is the education of every leprosy worker, present and future, in the fundamental principles of leprosy rehabilitation. This may not require a long course of training, but refresher courses of at least two weeks must be established separately for doctors and auxiliary workers (see Annex 2) to which every one in turn will be invited. In these courses new advances in medical, surgical and social aspects of leprosy should be taught by those qualified in these subjects.

All future training courses for doctors and auxiliary workers in leprosy must include some instruction in principles of rehabilitation.

#### *8.5.2 Physiotherapists and auxiliary physiotherapists for a leprosy service*

These workers are to be responsible for the education of patients in the prevention of deformities, for the non-surgical correction of deformities, for the treatment of ulcers, for the application of plaster and splints, and for the fitting of special footwear. They should also be able to prepare patients for surgical operations and to re-educate them afterwards. In centres in which physiotherapists are not available, auxiliaries may be employed ; these auxiliaries should be trained by experienced physiotherapists (see Annex 2).

### 8.5.3 *Surgeons*

Wherever there are already surgeons trained in reconstructive surgery, full use should be made of them by increasing the facilities at their disposal.

Centres for reconstructive surgery should be established at places where qualified surgeons are available.

Qualified plastic and orthopaedic surgeons should be given the opportunity to learn the special techniques required in leprosy work.

When it is not possible to obtain the co-operation of qualified surgeons, training of about two years may be given to suitable medical officers, who will subsequently be allowed to spend all, or the major part, of their time on surgical reconstruction. It is both wasteful and harmful to train medical officers for shorter periods or to give full training to those who will afterwards be engaged primarily in medical work.

Because of the lack of surgical training centres for leprosy, there is an urgent need to develop international training centres to which many countries may send surgeons and physiotherapists, who may subsequently start centres in their own countries.

### 8.5.4 *Social workers and occupational therapists for a leprosy programme*

In many countries there are no suitable training programmes for social workers and occupational therapists at the present time. In other countries qualified personnel will require additional training and experience for this work because of the special problems posed by leprosy and by anaesthetic limbs. In areas where there are only a few qualified workers, these may best be employed in training programmes for auxiliaries.

## 8.6 **Provision of rehabilitation services**

It was re-emphasized that the very early detection and treatment of leprosy patients represent the best means of preventing subsequent deformity.

Because it is not possible in areas with limited resources immediately to provide rehabilitation services for all leprosy patients, the Scientific Meeting listed in order the groups whose need was greatest.

#### (1) *Patients with easily correctible deformities*

(a) All patients with sensory loss in the extremities, even without present deformities, must be educated to prevent ulcers and deformity and provided with such aids as special shoes or sandals, improved handles for tools and cooking implements, etc.

(b) Physiotherapy auxiliaries can teach patients how to correct their own deformities by simple exercises and other remedial methods, and

can select patients suitable for transfer to centres for reconstructive surgery.

(c) Centres must be established for training such patients in a way of life and of work so that they may compete on equal terms with others in the labour market and in social life.

(2) *Severely deformed patients*

(a) Prevention of further deformities by proper education.

(b) Correction of existing deformities.

(c) Education of the public to accept the patient.

(d) Provision of craft training for those who need to change their jobs.

(e) For the small number who cannot be accepted at home, placement in a settlement, if necessary.

(3) *Completely disabled patients*

Patients who are blind or who have gross deformities, if they cannot be cared for at home, may require shelter and work in special homes. Such homes need not be for leprosy patients only, but may be combined with homes for paraplegics and others. Voluntary organizations should be encouraged to take up this work.

(4) *Undeformed and unmarked patients*

Such patients do not need surgical reconstruction or physical re-education unless they have sensory loss in their limbs. They do not require a rehabilitation service unless previous segregation has created a problem of re-acceptance in the community. In such cases they need social rehabilitation, aided by the social worker, who should maintain contact with the home and family of the patient while he is segregated. The patient should be trained in suitable crafts while he is in the institution.

### 8.7 Role of existing leprosaria

Existing in-patient leprosy institutions can serve the rehabilitation programme by becoming :

(1) Centres for reconstructive surgery, where proper personnel and equipment are available.

(2) Training centres for physiotherapy auxiliaries.

(3) Re-education centres and craft training centres.

(4) Sheltered employment centres for severely disabled patients.

## 9. EPILOGUE

“Too often it is assumed that rehabilitation should begin only after cure of the disease. In some diseases that sequence may be logical. In the case of leprosy, most of the psychological harm is done in the first few months after the diagnosis is made. It is then that despair strikes. It is then that the patient's whole world crumbles away. It is then that he begins to feel persecuted and to feel that no effort is worth while. That is the root of apathy, and it is a root that deepens and ramifies widely. *Rehabilitation must start on the day of diagnosis*, or as soon thereafter as the social worker can introduce the patient to the new world that for such a short time must replace his old, until he is ready to return, freshly equipped and with a welcome awaiting him.”<sup>1</sup>

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### Annex 1

#### CLASSIFICATION OF DEFORMITY<sup>2</sup>

For the careful estimation of the extent of deformity in different countries, the following scheme of classification is suggested. The Committee recommends that the information be related as far as possible to disease type, age and sex.

#### Scheme of Classification for Grading of Physical Disability Resulting from Leprosy

##### A. Hands

- Grade 1 — Anaesthesia to pain.
- ” 2 — Mobile claw hand. Useful thumb.
- ” 3 — Intrinsic paralysis involving fingers and thumb, or fingers only but with contracture.
- ” 4 — Partial absorption of the fingers but with useful length remaining.
- ” 5 — Gross absorption. Stumps only left.

##### B. Feet

- Grade 1 — Anaesthesia.
- ” 2 — Trophic ulceration (present or past).

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<sup>1</sup> *Rehabilitation Literature*, August 1960, 21, No. 8, p. 243.

<sup>2</sup> Reprinted from: *Wld Hlth Org. techn. Rep. Ser.*, 1960, 189, 22-23

- Grade 3 — Paralysis (drop foot or claw toes).  
 " 4 — Partial absorption of the foot (up to one-third of surface area of the sole lost).  
 " 5 — Gross absorption (more than one-third of the foot lost).

*C. Face*

- Type 1 — A permanent mark or stigma of leprosy not amounting to ugliness (loss of eyebrows, deformity of the ear).  
 " 2 — Collapse of nose.  
 " 3 — Paralysis of the eyelids, including lagophthalmos or paralysis of the facial nerve.  
 " 4 — Loss of vision in one eye or dimness of vision in both eyes (can count fingers).  
 " 5 — Blindness.

*D. Miscellaneous*

- Type 1 — Gynaecomastia.  
 " 2 — Involvement of the larynx.

*Note* : For record purposes it is suggested that it be stated whether conditions under A, B and D.1 are unilateral or bilateral.

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**Annex 2**

**TRAINING OF AUXILIARY LEPROSY WORKERS  
 IN THE RECOGNITION AND PREVENTION OF DEFORMITIES**

(1) The meeting felt it desirable to recommend suitable training to enable the ordinary auxiliary leprosy control workers in the field to understand the causation of deformity in leprosy, to recognize the early signs and to take steps to prevent the occurrence or development of deformities. At present such teaching is not normally included in their training.

(2) It was recommended that the auxiliary should be taught :

(a) The reasons, in general terms, why a leprosy patient is at special risk of deformity ; special emphasis should be laid on the hazards arising from loss of sensation in the extremities and to eyes from leprosy infiltration or from loss of protection.

(b) The fact that deformities can usually be prevented by proper treatment and care.

(c) Ways of recognizing the early sensory loss and signs of paresis, inflammation or damage which may lead to deformity.

(d) The importance of "reactions" in this context and their treatment.

(e) To put drops in eyes, to dress wounds and ulcers properly and to improvise means available in the locality of protecting a patient from trauma, fire, hot objects, bright sun, etc.

(3) Such teaching must include :

(a) How to recognize by signs in the skin early lepromatous or indeterminate cases and tuberculoid cases.

(b) How to test for sensory loss and in particular for presence or absence of pain perception and accurate localization of such on hands, feet and eyes.

(c) How to instruct a patient in protective measures against trauma and burns.

(d) How to inspect hands and feet for blisters and ulcers and to examine the foot for pain or tenderness in the five main danger areas.

(e) When and how to advise a patient to rest or to use rigid-sole footwear and how to provide the latter.

(f) How to instruct a patient with deformities of the hand to manipulate and exercise fingers to prevent further deformity.

(g) Instruction for the examination of the eyes with a good torch (flashlight), on the use of the 'E' chart to evaluate vision (the auxiliary must know his own vision in standard light on the 'E' chart for comparison), and to elicit answers to the following questions :

Does the patient have burning, watering, diminution of light or other ocular symptoms ?

Can the eyelids close completely ?

Is the eye red ?

Is the cornea clear ?

Does the pupil react to light ?

(h) Instruction on the following preventive measures :

In lagophthalmos the patient should be inspected regularly to detect changes ; the eyes should be shaded from sunlight ; at night, sterile castor oil should be dropped in the eyes, which should then be covered with a clean cloth.

If the patient's eyes are red and pupils not reacting to light, 4% homatropine should be instilled (except where intraocular tension is elevated). If there is evidence of corneal damage, the patient should be referred to a doctor.

(i) Instruction on how to decide when a patient should be referred to a physiotherapist or doctor for treatment of :

- Plantar ulcer.
- Swelling of foot or ankle with or without ulcer.
- Hand and foot paralyses.
- Contractures of hand.
- Lagophthalmos.
- Facial deformities.

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### Annex 3

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