

THE NEED FOR STUDY OF THE POTENTIALS OF SURGERY AND PHYSIOTHERAPY IN LEPROSY¹

WITH ESTIMATES OF FREQUENCY OF DISABILITY BASED ON FINDINGS
IN THE RYUKYUS

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*"... With further progress of the disease, after the patches have been in existence for some years, additional neural symptoms appear in the form of a decrease and finally a complete abolition of all sensation of the skin, as well as in the deep parts. This anesthesia tends to be most pronounced in the extremities, and is spread over the entire skin of the limb whether or not covered by the patches. There also appears a degenerative atrophy of the small muscles of the hand as well as of the foot; the muscles of the extremities in the proximal parts can also be affected similarly. Finally, there appear trophic changes in the bones of the fingers and toes, etc., which lead to the well-known mutilation of these parts. If all these changes are present, we get the complete picture of *Lepra maculo-anaesthetica*." Dehio, 1897 (²).*

I. THE NATURE OF THE PROBLEM

Among the numerous mycobacterial infections of man and animals it is only in human leprosy that invasion of the nervous system occurs, and here it is limited to peripheral nerves, the brain and spinal cord being exempt. The explanation of this unique host-parasite relationship is unknown, but, whatever the cause may be, the result is disastrous. Without nerve involvement, leprosy would still be a serious and disfiguring disease, but it would be much more amenable to chemotherapy. Furthermore, this peculiar part of the pathologic process causes most of the suffering, deformity and disability that occur, and much of the deplorable attitude of the public towards the patient. In other diseases, peripheral neuritis may be a painful complication; in leprosy it is a tragedy.

Damage to peripheral nerve trunks is the rule in both types of the disease, although it occurs earlier in the tuberculoid than in the lepromatous type.² The great intensity of the inflammatory process within

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²Reference is not made in this paper to those cases of the tuberculoid type in which the only external signs are macules. In certain of these cases the lesions may disappear completely or leave only anesthetic scars.

the nerves in the presence of few leprosy bacilli is one of the marked characteristics of the tuberculoid type. In the lepromatous type, however, as the disease advances the same nerve trunks become damaged or destroyed, and in far-advanced (burnt-out) cases it may be difficult to tell from physical examination whether the original disease was lepromatous or tuberculoid.

From the practical viewpoint, we are concerned here only with the fact that nerve trunks are invaded in leprosy, and not with the mechanism by which invasion takes place. We know that these nerves contain sensory, motor, and sympathetic fibers, and that damage leads to anesthesia, muscular atrophy, trophic changes in the skin and subcutaneous tissues, and absorption of bone.

In the lepromatous type, bacilli are readily found in the nerves and there is lepra-cell infiltration. Fine fibrous tissue is formed in the endoneurium which contracts and blocks and eventually destroys the nerve fibers. In the tuberculoid type, although few bacilli can be detected in the nerves, the cellular reaction is much more intense. Destruction of sensory fibers probably occurs first but soon there is total disruption of all neural elements. Necrosis is frequent within the nerve bundle. Eventually the nerve trunks may be enormously thickened. The explanation of nerve destruction in tuberculoid leprosy is not entirely obvious; ischemia and mechanical pressure, by themselves, appear inadequate to explain the rapidity and thoroughness of the process.

Rogers and Muir⁽¹⁵⁾ list the order of frequency in which nerves are affected as follows:

"The ulnar just above the elbow; the superficial peroneal to the medial side of the head of the fibula behind the knee; the radial as it curves round the humerus, or its branches as they pass over the lower end of the radius; the posterior tibial inferior to the inner malleolus; the great auricular as it runs parallel to and behind the external jugular vein; superficial branches of any nerve supplying a tuberculoid lesion."

This, of course, does not limit the involvement. The common high-stocking anesthesia of the thigh, for example, indicates invasion of the femoral nerve.

In a study which has been overlooked, Wayson and Badger⁽¹⁶⁾, writing in 1929, called attention to the rapidity with which affected muscles may show atrophy—sometimes within a week to 10 days "from the beginning of a disturbance in them." They observed that paralysis may begin acutely.

"A hand or foot or portion of the face may become reddened and greatly swollen, and in a few days, with the subsidence of the swelling, marked evidence of atrophy, with paresis or paralysis is present, the entire acute attack lasting only 10 days to 2 weeks."

They also noted that spontaneous recovery may take place:

"Regeneration may take place in nerves which appear from clinical findings to have been extensively degenerated. This is followed by a restoration of function in the parts

innervated, and areas of considerable sensory disturbance, as well as paralysed muscles, may return to relative normality. Even the destruction and absorption of bone may come to an apparently complete arrest."

It is emphasized that this is not the usual course of events.

Chatterjee (4) found himself unable to explain all the so-called trophic manifestations on the basis of nerve degeneration alone. Sometimes there was little or no sensory change in a patch with gross thickening of the associated nerve, and, on other occasions, marked sensory changes with little or no nerve thickening. Similar disproportion between nerve trunk involvement and the signs produced were observed in polyneuritic cases. After study of the anatomic and physiologic relationships involved, he concluded that the neural signs and symptoms of leprosy have a close relationship with the blood circulation of the affected parts, and that dilatation and constriction of capillaries may be independent of regulation through the sympathetic nerve fibers. Injection of hydnocarpus oil in affected parts and alongside the nerve supplying these parts was followed in some cases by remarkable results—return of strength in muscles and considerable restoration of sensation.

It has often been remarked that it is peculiar that the bone lesions of leprosy occur only in the bones of the hand and foot. Actually, there has been insufficient study of other bones. In any case, the selectivity relates primarily to the invasion of nerves supplying the extremities.

Barnetson (1, 2) has studied very carefully the x-ray appearance in 107 "neural" cases and the histologic picture in the bones of 4 "neural" and 1 "mixed" case. In the hands and feet the earliest changes occurred invariably on distal margins of terminal phalanges as minute nicks. These were previously described in detail by Murdock and Hutter (12). As these enlarged, the tuft lost its sharp outline and became frayed. This fraying was associated with breaks in continuity of cortical bone. The gaps were filled with connective tissue extending from periosteum to marrow. Later, the tuft disappeared and the phalanx consisted of the base and part of the shaft with a frayed, notched, or sliced-off distal margin or a drawn-out appearance of the shaft. Still later, the base of the phalanx remained as a flat disc which eventually disappeared and the process continued in the proximal bone. Periosteal reaction, osteosclerosis, and sequestrum formation were rare in the absence of secondary infection. Diffuse osteoporosis was uncommon. Concentric atrophy was seen fairly frequently, but only in proximal phalanges, metatarsals and metacarpals. Evidence of active osteoclastic activity, the generally accepted mechanism for bone absorption, was rarely seen in the histologic sections. The suggestion was made that possibly osteoclasts occur intermittently or on a slight scale in such an extremely chronic process. Changes in the bones were nearly always bilateral, but they were not truly symmetric in that lesions of corresponding digits on both sides were rarely in the same stage of evolution.

In a review of the literature on the pathogenesis of bone atrophy in leprosy Barnetson (³) described two principal patterns of bone lesions: (1) the basic bone lesion, where atrophy always begins on distal margins of the most distal bones of hands and feet and proceeds proximally, this being essentially the so-called "neurotrophic atrophy"; and (2) secondary bone lesions, in which further bone absorption can usually be related to fairly obvious secondary factors such as trauma. The basic bone lesion varies in accordance with the degree and duration of the interstitial neuritis, which causes failure of vasomotor response in vessels supplied by these nerves. In his opinion, this failure is the essential factor in bone atrophy. Among the factors concerned in secondary changes in bone he emphasized the importance of repeated trauma to insensitive bones and joints, and suggested that pyogenic infection of soft tissues—as well as and apart from pyogenic osteomyelitis—may play a part.

Lechat (¹¹) working at Yonda in the Belgian Congo, has reported x-ray findings on 315 institutional patients. The hands and feet were x-rayed in 75, the hand only in 51, and the feet only in 189. Some patients were segregated because they suffered from the lepromatous type; others because of physical disabilities. Lesions were demonstrated both in the bone and in the nutrient blood vessels. Periostitis was rare. Articular damage was secondary to destruction of epiphyses. Productive bone lesions were seldom seen, nearly all being of a destructive type. The bones of the feet were affected earlier than those of the hands, a fact which he considered to be related to the greater frequency of trauma and ulcers of the feet.

Erickson and Johansen (⁸) studied the bone lesions in 82 patients for whom there were available x-ray pictures of the bones of the hands and feet made over a period of five years. Of these cases, 91 per cent were of the lepromatous type. The most frequent finding was atrophic bone absorption, from slight concentric atrophy of the shafts of the phalanges to total loss of these bones, often with definite changes in metatarsals, metacarpals, and tarsal or carpal bones. The only other fairly frequent finding was definite bone-cyst formation, and their healing under sulfone therapy suggested that they were true lepromata of bone.

Practically all authorities stress the neurotrophic atrophy of bones. If this is the major cause of absorption and shortening and loss of members, the prospect for limitation of the damage appears almost hopeless. This has been expressed by Paterson (¹³) as follows:

"If the bone changes in leprosy are mainly neurotrophic and progressive, then elaborate tendon transplanting operations are clearly not worth while, but if it can be shown that the absorption of fingers and toes in leprosy is not progressive, and that such absorption can be prevented, then we are able to give to some thousands of leprosy patients in places like South India, the Philippines, and South Africa a reasonable hope

that with adequate treatment they will continue to be able to use their hands and earn their living."

Careful students of the problem have always emphasized the role of trauma and secondary infection in bone changes, and recently Brand (⁴) has laid great stress on this feature. He states:

"Many patients can remember incidents of trauma or burns, with sepsis, in association with most of the episodes of shortening of fingers. Even in well organized leprosariums it is common to find untreated and unnoticed open wounds on many anaesthetic hands . . . It is difficult, however, to define with precision the role of leprosy *per se* in absorption of digits, because in many wounds at least two pathologic processes may be simultaneously at work; the leprosy process and the simple traumatic and septic process. The practical significance of the distinction is that if anaesthesia and carelessness are responsible for finger absorption, it should be possible to show that absorption is preventable, even when the disease is not cured."

He concludes that if anesthetic hands can be guarded with more than ordinary forethought and care, they will not usually become absorbed. Brand is conducting the work of his clinic at Vellore from this point of view, emphasizing by frequent inspection the possible gravity of even the smallest cut or abrasion.

Repeated trauma of the anesthetic limb followed by secondary infection has another sequel—the trophic ulcer. As Kanakaraj (¹⁰) has stated: "The problem of the trophic ulcer in leprosy is a matter which has vexed generations of leprosy workers." He points out that these ulcers are the result of repeated trauma of the anesthetic limb, and remarks that surgery has contributed little to their management and that prevention is better than cure. He advocates preventive measures ranging from education of the patient to provision of orthopedic or specially-designed slippers.

II. THE EXTENT OF THE PROBLEM

In addition to the effect on the individual patient, the consequences of nerve damage add tremendously to the social and economic aspects of leprosy. Before the extent of these problems can be at all fully appreciated it will be necessary to collect much more complete information than is now available regarding both the prevalence of leprosy and the frequency of nerve damage in the principal types of the disease.

The number of recognizable cases of leprosy in the world is variously estimated at from 3 to 12 millions. Replies to questionnaires received recently by the Leonard Wood Memorial, with estimates for countries from which replies were not received, show a probable total of at least 3 millions of cases with about one-half of this number registered by the health authorities.

That the proportion of patients who are disabled in one way or another may be large is obvious to anyone who has visited a leprosarium. Institutional patients, however, constitute an uncertain proportion of total cases, and are selected in part at least because of disability.

It is difficult, therefore, to arrive at a reasonable estimate from the data of institutions. In a group of 250 patients in Hawaii, of whom 160 were inpatients, Wayson and Badger (¹⁹) made a close study of the frequency of neurologic signs and symptoms. The type of disease is not stated, but in 85 per cent of the cases *Mycobacterium leprae* was found in smears from the skin or mucous membranes, so most of the cases were probably lepromatous. In 98 per cent there was evidence of neuritis (painful attacks of neuritis, however, occurred in only 10 per cent) and in 62 per cent there were paralyzes within the regions of innervation of one or more nerve trunks. A striking feature was the frequency with which certain muscles were involved, the occasional rapidity of the paralysis, the degree of atrophy which occurred with slight or moderate loss of function, and the prominence of the sensory findings. In 50 per cent of the inpatients, the hand muscles supplied by the ulnar nerve were paralyzed, in 34 per cent the orbicularis palpebrarum and in 18 per cent the elevator muscles of the angle of the mouth. The muscles of the foot were involved in 17 per cent.

An approximation to the true frequency of disability caused by leprosy in the Ryukyu Islands is available from the unpublished results of a survey made by Dr. Fred C. Kluth and me in 1954. The principal facts are as follows:

From examination of 10,550 persons selected at random from the general population of areas considered representative, it was concluded that the number of unsegregated persons with leprosy was about 1 per 1,000 and that in most of these cases the disease was arrested. It is probable also that in these cases the amount of disability was minimal. In the two leprosaria, Airaku-en and Nansei-en, there were 1,250 patients, or 1.7 per 1,000 of the population. Thus, the proportion which was segregated was 63 per cent of the probable total persons with leprosy. The population of the islands was estimated as 760,800.

Every third patient at each of these leprosaria was examined, and it was found that in 45 per cent the disease was lepromatous and in 55 per cent tuberculoid. The examinations were made by experienced leprologists but not by orthopedic surgeons or by neurologists; consequently, the disabilities that were recorded may be regarded as the more obvious ones and the frequencies of each as below the true totals.

The grading of disability is difficult at all times. It is of interest, however, that the results obtained by the survey team in 1954 were closely in accord with the opinions of the resident staff as subsequently obtained from the clinical records of the institutions. At both places, taken together, 11.0 per cent of the patients included in the sample were classed as having no disability whatever, and 7.3 per cent had no disability and were negative bacteriologically. That is, there were probably about 90 patients (7.3 per cent of 1,250) at these institutions whose

leprosy or whose disability could not be used to justify segregation or hospitalization.

These cases, however, were the exception. The frequency and extent of disability had created a very serious situation. There was little difference between the sexes, but, as would be expected, the older patients were more frequently and severely affected than the younger, and those with the tuberculoid type more frequently than those with the lepromatous type. Some disability was present in 89 per cent of all patients, and moderately severe or severe disability was recorded in 51 per cent. Those classed as moderately or severely disabled included all who were totally blind, and all who had incapacitating contractures, amputations, or ulcerations. For those 40 years of age and over, disability of a moderately severe or severe grade was recorded in 59 per cent for the lepromatous type and in 82 per cent for the tuberculoid; and for those 15 to 39 years of age, 32 per cent for the lepromatous and 53 per cent for the tuberculoid. The number of younger persons suffering from the lepromatous type and included in the sample was small. Among children 5 to 14 years of age and suffering from the tuberculoid type, 27 per cent had slight disability and 73 per cent had none.

The percentages of patients with contractures or loss of part or all of hands or feet are shown for the two institutions in Table 1. Loss in most instances was partial, and a distinction was not made between natural and surgical amputation.

TABLE 1.—Percentages of leprosy patients in the leprosaria of the Ryukyu Islands in whom contractures of hands or amputations of hands or feet (usually partial) were present (examination by Doull and Kluth, 1954).^a

Type of leprosy	Sex	Per cent with contractures (one or both hands)	Per cent with amputations (natural or surgical)	
			One or both hands	One or both feet
Lepromatous	Males	47.1	26.1	20.2
	Females	46.2	21.5	21.5
	Both	46.7	24.5	20.7
Tuberculoid	Males	63.5	40.9	43.8
	Females	69.7	25.9	37.1
	Both	65.9	34.9	41.1
All patients	Males	55.9	34.0	32.8
	Females	59.7	24.0	30.5
	Both	57.3	30.3	31.9

^a Atrophy of muscles was recorded in many additional patients. In 6, not included in the above table, footdrop was noted—bilateral in 2 patients.

The percentages with contractures and with loss of members are high. If it is wished to obtain minimal percentages, for disabilities in

general or for contractures and amputations, applicable to all cases of leprosy existent in the Ryukyus, *on the assumption that all disabled patients were in the institutions*, it would be necessary to multiply the various percentages of Table 1 by the proportion which the segregated patients were of the estimated total, that is, by 63 per cent. This adjustment, in my opinion, underestimates the situation but the proportions with various disabilities nevertheless remain impressive. Proceeding on this assumption, the corrected frequency of moderate or severe disablement would be 63 per cent x 51 per cent, or 32 per cent. It can therefore be stated with confidence that the actual percentage was not less than 32 per cent and was probably higher. That is, about one-third of all leprosy patients in the Ryukyus were either totally unable to support themselves or were capable of only partial self-support.

The expected percentages of *all* patients suffering from each type of leprosy and showing certain selected orthopedic disabilities have been calculated in the same way, that is, by multiplying the actual percentages for the sample of institutionalized patients by 63 per cent. These percentages are shown in Table 2.

TABLE 2.—*Estimated percentages of all leprosy patients in the Ryukyu Islands, segregated and unsegregated, with various orthopedic disabilities.*

Disability	Type of disease	
	Lepromatous	Tuberculoid
Contractures (one or both hands)	29.4	41.5
Amputations (natural or surgical)		
Affecting one or both hands	15.4	22.0
Affecting one or both feet	13.0	25.9
Trophic ulcers (lower extremity)	20.7	38.1

The eye defects that were recorded in the Ryukyus were the obvious and more serious ones, and these constituted a minor proportion of the disabilities. Six per cent of all patients were blind in one or both eyes. Of the lepromatous patients, 3.4 per cent were totally blind, and 12.5 per cent were blind in one or both eyes. For the tuberculoid type, among the sample of 226 patients who were examined, only one was blind in both eyes and another had lost one eye. Inability to close one or both eyes (lagophthalmos) was noted in 17.2 per cent of patients suffering from the tuberculoid type and in 9.2 per cent of those with the lepromatous type. Again, if it be assumed that those patients with these eye defects were all in the institutions there would be expected to be, among all lepromatous patients, segregated and unsegregated, at least 2 per cent who were totally blind and 8 per cent who were blind in one or both eyes; and, among all tuberculoid patients probably fewer

than 1 per cent who had lost one or both eyes. Among all lepromatous patients, 5 per cent would be expected to show lagophthalmos affecting one or both eyes, and among all tuberculoid ones, 11 per cent.

The clinical picture of leprosy is by no means a universal one. It is well known, for example, that the proportion which the tuberculoid type bears to the total is very much higher in some areas than in others. Also, it is apparently true that certain features of the lepromatous type, notably lepromatous eye lesions, are more frequent in temperate climates than in the tropics. The average duration of life is another factor to be considered, since the proportion of leprosy patients who are disabled increases with age. These considerations lead to caution in projecting more broadly the frequencies of various disabilities applicable to any one country.

If the data for the Ryukyus be accepted as representing minimal frequencies, and a total world prevalence of three millions of cases also be accepted, there must exist throughout the world not fewer than one million persons who are moderately or totally disabled by leprosy. If, on the average, at least one-half of the cases are tuberculoid in type, there must exist at least one million persons with contractures of one or both hands, 560,000 with natural or surgical amputations affecting one or both hands, and about 730,000 with such amputations affecting one or both feet. Considering only the lower extremity, the number with trophic ulcers cannot be fewer than 880,000.

These are, of course, prevalence figures. We are entirely without an adequate basis on which to estimate the number of persons becoming disabled from leprosy each year.

III. POSSIBLE VALUE OF CHEMOTHERAPY

Apart from the observations of Erickson and Johansen (⁸) on healing of the rather rare, and probably lepromatous, cysts in bone under sulfone therapy, there is no evidence that any type of therapy can prevent or limit the nerve damage and its sequelae. Those authors were of the opinion that, apart from healing of cysts, there may also occur "a restraint on further progress of atrophic bone absorption," but they recognized the need for further observations.

If the sulfones are of value it would seem to be imperative that they be given early, before extensive damage to the nerve has taken place. This brings up, first of all, the practicability of earlier recognition of cases—for which there is no simple formula. At present, the disturbing fact must be stressed, namely that signs of nerve involvement are often the first indication of leprosy. With the extension of outpatient clinics, coupled with educational programs, there will undoubtedly be some decrease in the period between onset and recognition. Other measures such as periodic examinations of the general

population are impracticable in most countries where the disease is endemic.

These considerations should not in any way discourage the search for early cases, or the immediate treatment of these when they are found. In some countries earlier treatment may be entirely feasible, and although the value of sulfone therapy in limiting nerve damage has not been demonstrated, neither can it be denied.

IV. CORRECTIVE SURGERY

Until comparatively recent years, surgery in leprosy consisted mainly of amputations of entirely useless members or removal of sequestra in the case of deep-seated trophic ulcers. Various operations on thickened nerves were carried out in a few centers. Marginal tarsorrhaphy was found to be useful in many cases of paresis of the orbicularis muscle. In some places, deformities of the face and ears were improved by plastic surgery. Within the past decade, however, a few orthopedic surgeons have realized that a much wider need exists, and that application of modern orthopedic and physiotherapeutic techniques might yield great dividends.

In 1947, the work of the Department of Physical Therapy at the Public Health Service Hospital, Carville, Louisiana (National Leprosarium) was greatly extended, as has been described by Hatch (⁹). Riordan (¹¹) has been remarkably successful in restoring function to hands which were almost useless. In less severe cases good results have been achieved. The operative procedures in many cases must be carried out in stages, and physiotherapy continued for prolonged periods. This requires perseverance on the part of both surgeon and patient.

Brand (⁴), who has probably had the largest experience in hand surgery in leprosy, has stated that the most important part of any hand-reconstruction center is a well-staffed physiotherapy department, and the work of this department at Vellore has been described in a most effective manner by Thomas (^{16, 17, 18}).

From the practical point of view, Brand emphasizes that the most useful fact is that the median nerve above the wrist is spared in leprosy. He divides the hands into three groups:

(1) Those with a pure ulnar palsy, comprising 46 per cent of his clinic cases but a larger proportion when mild and early cases are considered. This group may have anything from minimal small muscle weakness to total paralysis of all ulnar-supplied muscles of the forearm and hand.

(2) Those with a total ulnar paralysis and, in addition, paralysis of the median-supplied muscles below the wrist, comprising 52 per cent of his clinic cases. This group has clawing of all fingers and a thumb that is unable to abduct or oppose the fingers in a grasp or pinch.

(3) Those with a total ulnar paralysis, median paralysis below the wrist, and total paralysis of radial-supplied forearm muscles. This group comprised only 1.5 per cent of his clinic cases and had totally useless hands.

"Even in the absolutely helpless hand of Group 3, with complete clawing and extensor palsy, there are at least 10 useful and powerful forearm muscles remaining. They are all flexors, and are useless only because they are unbalanced by extensors and stabilizers. A five-year follow-up study on many of the earlier hand-reconstruction operations has shown that these median-supplied forearm muscles continue to function and even to improve their range and power after transfer of their tendons to restore muscle balance to the hand."

As regards the foot, Brand has found a similar pattern and limitation of paralysis to those in the hand. The plantar-flexing and inverting muscles are unparalyzed, whereas the dorsiflexing and everting muscles, and all the small muscles, may be paralyzed. This leads to clawing and to footdrop. He states: "Both these disabilities are correctable."

Carayon and Huet (⁵) have recently reported encouraging results from remedial surgical operations on 40 patients in French Morocco. Their article is well illustrated and has an extensive bibliography.

V. SUMMARY

The problem may be summarized as follows: The number of persons suffering from leprosy is very large—certainly several millions, scattered over a wide geographic area but for the most part in warmer climates. Disability is present in more than one-half of existent cases, and occurs ultimately in nearly all. This varies from a slight handicap with only contractures of the fingers to total physical disability with extensive loss of distal parts of the limbs. Disability occurs earlier in the tuberculoid than the lepromatous type, but in the end it is equally frequent in both types. It is accompanied and contributed to by loss of perception of pain, light touch, and change in temperature in the areas supplied by the affected nerves. Involvement of the temporal and zygomatic branches of the facial nerve is very common and frequently bilateral, leading to inability to close the eyelids tightly with consequent exposure of the cornea to injury. Invasion of the eye, infiltration and nodulation of the skin of the face and ears, ulceration, and scarring add to the deformity in the lepromatous type.

Absorption of the bones of the hands and feet has long been considered an inevitable consequence. Recently a more hopeful outlook for prevention has been presented. It is claimed that in a substantial proportion of patients the shortening and eventual loss of digits is caused by secondary infection of wounds or abrasions, to which the anesthetic hand and foot are especially subject. If this view is correct, the prevention of infection becomes a matter of greatest importance.

Final considerations which add to the seriousness of the problem are that nerve damage is present in many patients on discovery, and

that present-day chemotherapy cannot be counted on to reverse, and probably not to limit, the degenerative process in the nerves. This latter statement should not be interpreted as implying that early sulfone treatment may not have a beneficial effect, but only that such an effect has not yet been demonstrated.

VI. RECOMMENDATIONS

Because of the tremendous problem of physical disability in leprosy, there is urgent need for better understanding of the technical procedures of orthopedics, plastic surgery, and physiotherapy, which are now being advocated, and for research to ascertain their values and limitations. There is also need for more precise definition of the problem so as to determine in each endemic area, the approximate prevalence of specific defects in leprosy patients of various ages and both sexes, both segregated and unsegregated.

International action seems to be indicated to draw attention to these needs, to assist in training physicians and physiotherapists in physical and occupational rehabilitation, and to guide necessary rehabilitation activities.

Among the questions on which it is essential to have expert guidance are:

1. A practical program for correction of contractures, applicable especially to young children, in countries with high leprosy prevalence and limited medical resources.
2. The educational and other measures which should be taken to prevent secondary infection in patients with anesthesia of the hands or feet, and the probable value of these measures.
3. The recommended surgical and physiotherapeutic measures for restoration of useful function in hands and feet that are more or less seriously damaged.
4. The measures which should be adopted to prevent and cure trophic ulcers.
5. The role of plastic surgery.
6. The occupations which are most suitable for patients with various disabilities.
7. The training of surgeons and physiotherapists.
8. The equipment essential for carrying out a suitable program of surgery and physiotherapy.
9. The provision of expert surgical and physiotherapeutic services in countries with few facilities for inpatient care, and the possible value of travelling teams or clinics under these circumstances.

10. Methods by which governments can assess the magnitude and severity of the disability problem in leprosy.

RESUMEN

Cabe sumarizar el problema en la forma siguiente: El número de personas que padece de lepra es muy grande—seguramente varios millones, esparcidos en una vasta zona geográfica y en su mayor parte en climas cálidos. Hay incapacidad en más de la mitad de los casos existentes, y afecta a la larga a casi todos ellos. Esto varía de leve impedimento con apenas contracturas de los dedos a total incapacidad física con extensa pérdida de las porciones distales de los miembros. La incapacidad aparece más tempranamente en la forma tuberculoidea que en la lepromatosa, pero al final alcanza frecuencia igual en ambas formas, yendo acompañada de pérdida de la percepción del dolor, tacto ligero y alteraciones térmicas en las zonas servidas por los nervios afectados, y participando todos estos factores en aquélla. La invasión de las ramas temporales y cigomáticas del nervio facial es muy común y frecuentemente bilateral, conduciendo a incapacidad para cerrar firmemente los párpados, con la consiguiente exposición de la córnea al traumatismo. En la forma lepromatosa, contribuyen a la deformidad la invasión del ojo, la infiltración y nodulación de la piel de la cara y las orejas, la ulceración y el tejido cicatricial.

Por largo tiempo se ha considerado como consecuencia inevitable la absorción de los huesos de los manos y los pies, pero recientemente se ha ofrecido una perspectiva más optimista en cuanto a prevención. A légase que, en una proporción substancial de los enfermos, el acortamiento y la pérdida eventual de los dedos proceden de la infección secundaria de las heridas o excoriaciones, a las que son en particular propensos la mano o el pie anestésico. Si es acertada esta opinión, la prevención de la infección se vuelve punto de la mayor importancia.

Consideraciones finales que acentúan la gravedad del problema son que ya existe lesión nerviosa al descubrir el caso en muchos enfermos, y no puede contarse con que la quimioterapia invierta, y probablemente tampoco limite, el proceso degenerativo en los nervios. No debe interpretarse esta última declaración como presuponiendo que la sulfonoterapia temprana no puede ejercer efecto beneficioso, sino puramente como señalando que no se ha observado todavía dicho efecto.

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