Volume 66, Number 3, September 1995

LEPROSY REVIEW

Published Quarterly for the
British Leprosy Relief Association

ISSN 0305-7518

Leprosy Review

A journal contributing to the better understanding of leprosy and its control

LEPRA

Editorial Office: LEPRA, Fairfax House, Causton Road, Colchester CO1 1PU, England
Assistant Editor: Jennet Batten, 94 Church Road, Wheatley, Oxon OX33 1LZ, England

Leprosy Review is published by LEPRA with the main objective of contributing towards the better understanding of leprosy and its control. Original papers on all aspects of leprosy, including research, are welcomed. In addition, *Leprosy Review* seeks to publish information of educational value which is of direct benefit to the control of leprosy under field conditions, and hence to the individual patient. The Journal aims to interpret what is being done in other disciplines, particularly for field workers.

From time to time the Editorial Board invites special articles or editorials from experts in various parts of the world, and gives consideration to the production of a supplement or special number devoted to a particular subject or theme of major importance.

LEPRA
Registered Offices: Fairfax House, Causton Road, Colchester CO1 1PU

Lepr Rev (1995) **66,** 193–200.

Editorial

DEFORMITIES AND DISABILITIES— UNFINISHED AGENDA IN LEPROSY WORK

Leprosy problems

From time immemorial leprosy has presented 3 different kinds of problems to mankind. Because there were no effective remedies, it was seen as an incurable disease and so as a medical problem; and as it was seen as a disease capable of spreading from person to person, it was also seen as a health hazard to normal people, i.e. as a public health problem. The disease was also seen as causing bodily impairments, leading to hideous deformities of the face and crippling disabilities involving sight, tactile sensibility, manual dexterity, mobility and even speech. This feature, coupled with incurability and infectiousness, made the community view the disease and the affected persons with abhorrence, as objects to be feared, hated and excluded, and the affected persons similarly perceived themselves. Thus, they lost their status as human beings in their own eyes and in the eyes of their fellow men; and suffered enormously as a consequence. This was the third 'human problem' presented by leprosy.

We must not forget that it was this human problem that moved the hearts and minds of compassionate people all over the world to take up and sustain 'leprosy work' long before any effective remedy was available against the disease; and spurred them to launch and intensify leprosy control and elimination programmes, through governments and voluntary organizations all over the world, as soon as effective remedies against the disease became available. It is particularly important that we remind ourselves of this historical fact.

The advent of dapsone as an effective antileprosy drug signalled the end of leprosy as a medical problem. With the introduction of multidrug therapy (MDT), with rifampicin as an essential component, the medical problem of leprosy has been virtually solved. Leprosy is now an eminently curable disease and future developments can be expected to improve further the situation and provide newer drug regimens to cure the disease even more quickly than now.

Thanks to the above developments, and the concerted efforts of national governments, national and international funding agencies and voluntary organizations, mainly through the sustained endeavours of the World Health Organization (WHO), there has been an enormous mobilization of resources towards making MDT available to all leprosy-affected persons worldwide. The successes achieved so far by way of acceptability of the MDT regimens, reduction in the prevalence of the disease and the very low

0305-7518/95/066193+08 $01.00

rates of relapses show that we now have an effective and robust technology to meet the challenge of leprosy as a public health problem.[1] Provided that leprosy work continues with the same input and enthusiasm as at present, we may expect leprosy to become rare even in areas where it was rampant only a few years ago.[2] We may expect, therefore, that in the very near future leprosy will cease to be a major public health problem.

These spectacular successes in solving the medical and public health aspects of leprosy seem to have created a general impression that the 'leprosy problem' has been virtually solved. The unfortunate choice of the word 'elimination' to indicate the goal of tackling leprosy as a public health problem has helped to strengthen this impression, despite cautionary statements to the contrary, from the WHO as well as others.[3–6] Some leprosy organizations, both voluntary and governmental, have even started (or are seriously planning) to diversify in to other fields, such as tuberculosis or AIDS.

This is a very disquieting scenario because, by vigorously implementing the current MDT programmes we would have carried out only the minimal necessary and relatively easier task of curing all leprosy-affected persons with MDT. The 'human problem' of leprosy, which has been the motive force of all leprosy work, has hardly been touched on a large scale. Leprosy-related problems such as deformities and disabilities, loom large as the major contributors to the human problem.[7] Now is the best time for tackling the problem of leprosy-related impairments. The opportunity should not be missed as it will not come again—more on this later.

It is not that we lack knowledge or skills in this area. In fact, ever since leprosy became curable with dapsone, about half a century ago, a number of persons, mainly surgeons and allied paramedical professionals in some institutions, have been gathering experience, developing expertise, carrying out research, collecting information and working out solutions for these problems. In this way reliable knowledge and experience in this field has been accumulated. Nevertheless, despite all our efforts over all these years, we have managed to intervene and improve the life of only a very tiny proportion of affected persons with leprosy-related problems. It is evident that something is not right and the need now is to re-examine the situation, look at the problems afresh and determine our goals, aims and strategies accordingly. This has to be done taking current realities into consideration, since much of our ideas and attitudes are based on experiences now rendered obsolete by the recent and large scale implementation of MDT all over the world.

Current realities

First, in places where MDT projects have been implemented efficiently for 5–7 years, more than 95% of persons with leprosy-related impairments are outside the orbit of activities of the leprosy programmes. It is very likely that such persons are far more numerous than those currently taking treatment for leprosy. A proportion of them may be nominally within the programme as 'cases under surveillance' for the present, but the rest of them are completely outside the programme as 'released from control'.

Second, surveillance is not carried out with the same efficiency and enthusiasm as treatment (MDT) activities. Even when conducted diligently, surveillance involves seeing recently treated leprosy-affected persons once a year, for a few minutes, for 2–5 years. It has recently been proposed that even this meagre surveillance programme should be dispensed with, because relapses after MDT (the main reason for surveillance) are too few.[1,8,9]

Third, as MDT projects progress, more and more persons suffering from leprosy-related impairments will be returned to the community as 'disease cured', which means more and more such persons will be beyond the reach of the safety net of leprosy programmes.

Fourth, the existing specialist leprosy institutions with the needed expertise in deformity management etc., are hopelessly inadequate in numbers to meet the situation, and we cannot expect persons with leprosy-related impairments to travel long distances to strange places for each different problem every so often.

Fifth, the main problem is not persons developing impairments for the first time. As with leprosy control, the main problem is the backlog of prevalent cases, namely those who have already developed some impairment such as loss of sensibility or muscle paralysis. Many workers, including physicians, continue to think that we can significantly reduce the quantum of leprosy-related impairments if only it was possible to monitor patients more carefully during treatment, recognize impairment-inducing conditions such as reactions and neuritis very early, and initiate 'proper' treatment. This idea is based on our past experiences, especially in institutions, during the dapsone days. It has become obsolete now because leprosy patients are under treatment for such a short period (and we may expect the treatment period to become even shorter still in the near future) and only a tiny proportion of those taking treatment will develop impairments for the first time while under treatment, or afterwards, and thus get added to the existing pool of such persons.[10,11] The primary problem, therefore, is persons who already have leprosy-related impairments becoming worse and not that of leprosy-affected patients developing impairments for the first time.

Sixth, unless special measures, referred to as 'Disability Prevention Practices', are taken and continued indefinitely, persons having leprosy-related impairments will inevitably worsen in their impairment-disability status irrespective of whether their deformities are corrected or not, or whether they have been rehabilitated or not. Sooner or later, the insensitive and dry parts (eyes, hands, feet) will develop wounds and ulcers and the joints affected by muscle paralysis will develop progressively increasing stiffness.

Seventh, leprosy workers, however motivated, knowledgeable and compassionate they may be, can provide only periodic, occasional or one-off interventions to help affected persons, whereas 'disability prevention' requires conscious and continuous care for the rest of their lives.

Finally, as already stated, we in the leprosy sector have sufficient knowledge and skills to prevent any worsening of the impairment-disability status of leprosy-affected persons.

New goals and aims

It should be evident from the above that leprosy workers cannot prevent the worsening of most leprosy cases with impairment disabilities, although it is known how to achieve this, and that the outcome rests with the efforts of the affected persons themselves. In short, leprosy workers have the solution but the affected persons have the problem. This in essence has been and continues to be the core of the problem. When viewed in this manner, it becomes obvious that, instead of concentrating our efforts on preventing impairments in affected persons, we should direct our activities at empowering affected persons to prevent

the worsening of their impairment status by their own initiatives and efforts. It appears that we can achieve our goal of preventing worsening of the impairment-disability status of leprosy-affected persons only through the strategy of empowering them and supporting them in this regard. Achieving this will be more difficult than putting pills and capsules into the mouths of patients and making them swallow. These difficulties arise because in a programme of this sort we are attempting to change people's attitudes and behaviour for intangible, long term, negative benefits ('no worsening of impairments and disabilities'). The difficulties are further increased because in carrying out a programme of this kind, namely empowering people, leprosy workers will have to learn to play a role quite different from their traditionally recognized and appreciated role as providers of certain goods and services in the health sector. Thus, this programme also aims at changing our own attitudes and behaviour for intangible, long term and uncertain (uncertain because we are dealing with human beings) benefits ('the affected persons become skilled in disability prevention and use those skills in their daily lives').

Empowerment and its requirements

The term 'empowerment' is commonly used in the political–sociological context to refer to a state of socially sanctioned authority and power to act. It thus indicates a state of self-reliance and nondependence on external agencies for exercising that power. It also implies the availability of supportive services to provide assistance in areas beyond the reach of the local community, and easy access to them, in order to make empowerment meaningful. While in legal parlance individuals are usually empowered to do something, in political–sociological parlance it is communities or classes of people, previously powerless, which are sought to be empowered to order their lives according to their needs in certain contexts. 'Empowerment', therefore, involves possession of requisite knowledge, acquisition of needed skills, the freedom to use them and ready access to support facilities.

The 3 key aims of activities in implementing a comprehensive project to empower leprosy-affected persons to prevent the worsening of their impairment-disability status by their own efforts will be: (i) changing attitudes and behaviour; (ii) technology transfers; and (iii) creation and strengthening of certain support facilities. These activities need to be targeted towards 3 different groups: (i) leprosy programme personnel at all levels; (ii) general health care professionals at different levels; and (iii) certain sections of the local community (namely persons suffering from or likely to develop leprosy-related impairments, their family members and local community volunteers and opinion leaders). These activities mutually reinforce each other and so they need to be carried out concurrently and not serially. However, because of practical constraints, we may start with the activity that is most feasible in the given situation in order to pave the way for taking up the other 2 at the earliest convenience.

The core objectives of the 3 activities listed above *vis-à-vis* the 3 target groups also listed above are briefly outlined below.

CHANGING ATTITUDES AND BEHAVIOUR

As mentioned earlier, leprosy programme personnel at all levels should thoroughly

understand the need for the empowerment of affected persons and the community, its requirements, and change the concepts of their roles and actions accordingly, from being providers of certain goods and services to becoming facilitators, trainers and catalytic agents to bring about the required outcome, which is to make affected persons and local community self-reliant and take responsibility in the matter of 'disability prevention'.

General health care professionals should also understand what leprosy workers are trying to achieve, and change their attitude towards their obligations to leprosy-affected persons from neglect and indifference to acceptance and willingness to shoulder their responsibility in the programme.

The targeted public and local community are expected to change their customary attitude of fatalistic acceptance of their lot and helpless dependence on the leprosy programme, and others, to an attitude of informed self-reliance and non-dependence, and start acting accordingly.

TRANSFER OF TECHNOLOGY

A successful disability management programme that empowers the community depends on a variety of technology transfers and training programmes of different complexity to effect those transfers. By 'technology transfer' I am referring to a shift in the possession of relevant knowledge and skills from one party to another through appropriate training programmes in a planned manner.

There are 3 kinds of technology transfers involving the 3 parties required here:

(i) The leprosy programme staff at all levels need to develop the skills for motivating and activating affected persons and other target groups in the community. This will require technology transfer from social scientists and community workers like community-based rehabilitation (CBR) personnel and social workers, to the leprosy programme personnel through appropriate training programmes.

(ii) General health care professionals at 2 different levels will need to develop knowledge and skills from the leprosy programme:

(a) at field or peripheral level—to replace or assist leprosy programme personnel on a continuing basis (for the identification and training of target persons and groups as well as to treat locally treatable conditions); and (b) at regional or district level—physicians and specialists should be trained to provide higher level medical care, particularly in the management of deformities, neuritis and reactions and in the treatment of complicated foot and eye problems as well as for the provision of orthotic and prosthetic devices and other appliances.

(iii) The 3rd and the most crucial technology transfer involves target persons and groups in the community (affected persons, their family members and community volunteers). The required knowledge and skills for 'disability prevention' now residing with the leprosy sector need to be transferred to the target groups so that they become knowledgeable about leprosy-related impairments, become skilled in their recognition, management and prevention and become motivated to practise those skills in their daily lives. This is the most important activity and all the other activities are for re-inforcing this and are, in fact, aimed at making this succeed. If this fails, the entire purpose of the 'disability prevention' programme is lost.

SUPPORT SERVICES

There will be many problems which cannot be tackled by the affected persons at the peripheral level using simple measures. In order to meet them successfully supportive services will be required, without which all talk about 'empowerment' will be a meaningless mockery and all efforts towards empowerment will be doomed to become misspent. Therefore, creation and strengthening of appropriate support services and making them easily accessible to affected persons is an essential component of the empowerment strategy.

In the present context of our discussion, support services are needed to serve 3 different purposes: (i) providing aids and appliances, namely protective footwear, splints (for fingers mainly), orthotic/prosthetic and other appliances like grip aids, etc.; (ii) treating locally treatable conditions, particularly ulcers, at the peripheral (control unit/health centre) level; and at a more central (district or regional level); and (iii) providing higher level medical care for dealing with the complications of leprosy as well as for correction of deformities and improvement of disabilities and treatment of complicated foot problems, including recurrent plantar ulcers. Meeting the above needs requires strengthening the services already available with the leprosy sector and the general health care services.

Besides the above, there is another very important support facility that has to be created—that is having an informed and interested community prepared to intervene in the interests of those with impairments and disabilities, including leprosy-related ones. This can play a very positive role by providing a favourable climate for disability prevention and management as well as for obtaining active help from local resources for various disability-related activities, such as the supply of aids and appliances, community-based rehabilitation and even professional help from local private medical and industrial organizations. Table 1 summarizes the core objectives mentioned above.

Now is the time

It will be seen from the above that 'leprosy work', contrary to what many people seem to think, is far from 'finished'. The achievement of 'elimination of leprosy as a public health problem' marks only the beginning. After that, we must not be distracted by the medical and public health problems of leprosy, from making the 'final assault' on the millenia old human problem of leprosy. But that does not mean we have to wait till the elimination goal is achieved. In fact, if we do that, it will be too late. Now is the time to start, for a number of reasons. First, the climate is just right at present, with MDT showing great reductions in prevalence, whereas there is the danger that the present positive proactive disposition among governments, workers and donor agencies will disappear by the time we achieve world-wide elimination. Second, experts in this area are, after all, mortal human beings, and by that time, the hard-won expertise developed over the last half a century and available till now will also have become quite scarce, making the initiation of training programmes on a large scale difficult, especially in deformity correction and ulcer management. Third, the work load of leprosy field workers has diminished considerably in MDT project areas and in these persons we have a ready source of manpower familiar with leprosy-affected persons and their problems as well as the local

Table 1. Core objectives of 'empowerment' activities vis-à-vis target groups

Empowerment activity	Target groups		
	Leprosy programme personnel	General health care professionals	Local community*
1 Change attitude and behaviour	From being providers of goods and services to becoming facilitators and trainers	From an attitude of neglect of leprosy-affected patients to accepting and caring for them	From being dependent on leprosy services to becoming self-reliant
2 Transfer technology	Learn from social scientists and community workers to function as facilitators, trainers and catalytic agents of change	Learn disability management and deformity correction from the leprosy sector	Learn to manage leprosy-related impairments themselves
3 Provide support facilities	(a) Treat locally treatable conditions especially plantar ulcers; (b) help to acquire aids and appliances; and (c) arrange referral facilities for higher level medical care	(a) Treat locally treatable conditions; (b) provide higher level medical care; and (c) arrange and supply aids and appliances	Build community support for CBR, supply of aids and appliances and services from private medical sector and others

*Local community here refers to: persons with leprosy-related impairments, disabilities and handicaps, their family members, local community volunteers and opinion leaders.

communities, for our use. Such an asset will not be available later and it should not be frittered away now in other areas just because leprosy has been 'eliminated' as a public health problem. Fourth, many among the field workers are still not quite satisfied with their achievements, despite the success of MDT, because they find that the miserable lot of persons with leprosy-related impairments, deformities and disabilities has not changed in any way. Motivating them now in 'Disability Prevention' will not be difficult. Lastly, viewing this exercise from a broader perspective, the experience gained in implementing empowerment projects in leprosy will prove very valuable for use in other health-related and community-based rehabilitation work for which a base will have been created where no such base exists now.

H. SRINIVASAN

'Beach Residency'
12/1, First Seaward Road
Valmiki Nagar
Madras-600 041
India

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Role of reactive oxygen species in renal damage in experimental leprosy

N. AGNIHOTRI*, N. K. GANGULY†, S. KAUR*, M. KHULLAR†, S. C. SHARMA* & K. S. CHUGH‡
**Department of Dermatology, †Experimental Medicine and ‡Nephrology, Postgraduate Institute of Medical Education and Research, Chandigarh-160012, India*

Accepted for publication 25 April 1995

Summary Renal involvement is known to occur in leprosy. In the present study the possible role of reactive oxygen species (ROS) in causation of renal damage in mice infected with *Mycobacterium leprae* has been investigated. At least six animals from each group (control and infected) were killed at 0 day, 3, 6 and 9 months postinfection. The results showed a significant increase in the chemiluminescence (CL) response of peritoneal macrophages which was maximum between 3 and 6 months. No significant increase was observed in CL response of blood neutrophils. A significant increase in lipid peroxidation was observed at 3 and 6 months as evident by an increase in malondialdehyde levels. The increased ROS production might be the cause of lipid peroxidation. The renal damage is also evident by decrease in the activity of renal brush border membrane enzymes, namely, alkaline phosphatase, leucine aminopeptidase and r-glutamyl transpeptidase. Thus ROS might play a role during early stages of *M. leprae* infection but in the later stages other immunological mechanisms may overpower the effect of ROS.

Introduction

Renal involvement is known to occur throughout the spectrum of leprosy. The renal manifestations of leprosy need special attention as autopsy studies from India, Japan and Panama revealed that 11–37% of leprosy patients die of renal failure.[1] Recently Rajan *et al.*[2] reported that mortality due to renal failure was the single largest cause of death among leprosy patients. It is important therefore, to be aware of renal manifestations of leprosy.

The exact mechanisms of renal involvement in leprosy is not known. Most of the studies done to date have focused attention on the histopathological, immunological, bacteriological and functional aspects. However, very little information is available regarding the biochemical mechanisms involved in renal damage. Renal dysfunction may be present even in the absence of morphological changes. The aetiology of this

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dysfunction whether, *Mycobacterium leprae* or some other simultaneous infection is not known.[3] The aetiology and pathogenesis of renal disease in leprosy, therefore, appears to be complex and multifactorial.

Since *M. leprae* is an intracellular pathogen and immune complexes are known to occur in leprosy, the possible role of reactive oxygen species needs evaluation. The reactive oxygen species (ROS), which include superoxide anion ($O_2^{-\bullet}$) hydrogen peroxide (H_2O_2), hydroxyl radical ($OH^{\bullet}$) and singlet oxygen ($^1O2$) are produced by univalent reduction of molecular oxygen. Such ROS are being increasingly recognized as mediators of cell injury in various pathogenic states.[4,5] Although all the cell components are susceptible to attack by free radicals, lipids; particularly those containing unsaturated fatty acids, are notably so.[6,7] The oxidation of lipids by these radicals generates a series of lipid peroxides, hydroperoxides and aldehydes which are highly reactive and toxic.[8] The ROS mediated tissue damage can be demonstrated by measuring malondialdehyde (MDA), a product of lipid peroxidation. The formation of lipid hydroperoxides in membranes would result in damage of the membrane structure[9,10] and the inactivation of membrane-bound enzymes.[11,12] In the present study, we have investigated the possible role of ROS in causation of renal damage. The production of ROS was evaluated by measuring the chemiluminescence response of peritoneal macrophages and blood neutrophils and renal damage was studied by measuring malondialdehyde level and assessing specific renal brush border enzymes, namely, alkaline phosphatase, leucine aminopeptidase and r-glutamyl transpeptidase.

Materials and methods

EXPERIMENTAL MODELS AND GROUPS

Closely bred lacca strain of Swiss albino mice (susceptible to footpad infection by *M. leprae*), 3–4 weeks old and raised in the Central Animal House of the Postgraduate Institute of Medical Education & Research, Chandigarh, India were used in the present study. The animals were divided into two groups:

Group I consisted of 60 normal mice injected with normal saline in the right-hand footpad and served as control group.

Group II included 60 mice given *M. leprae* infection (1×10^4 *M. leprae* s/c) in the right-hind footpad by the method of Shepard[13] using human skin biopsies from lepromatous leprosy (LL) patients with high bacillary counts (BI 4+ to 6+).

The animals from each group were killed periodically at 0 day, 3, 6 and 9 months after removing peritoneal fluid and blood. All the experiments were carried out in triplicate and the following investigations were carried out.

SEPARATION OF PERITONEAL MACROPHAGES AND BLOOD NEUTROPHILS

The peritoneal macrophages were obtained by the method as described by McCarron *et al.*[14] without injecting any eliciting agent. Briefly, the peritoneal macrophages were obtained by injecting McCoy's medium into the side of abdominal cavity and the distended peritoneal cavity was massaged gently and the fluid was aspirated out. The cells were then washed twice in McCoy's medium by centrifugation (225×G, 10 min at 4°C) and suspended in 2 ml of McCoy's medium. The cells were kept for sticking in

35 mm petriplates at 37°C in a humidified CO_2 and 95% air atmosphere for 90 min and the adherent cells were detached gently with a rubber policeman. The cells were aspirated out, counted and diluted.

For isolation of neutrophils, blood was collected by cardiac puncture and transferred to a siliconized centrifuge tube containing 0·2 ml of 3·5% dextran and 20 μl heparin. The tubes were shaken and kept at room temperature for settling of the dextral red cell agglutinates. Neutrophils were separated from the blood by the method of Boyum.[15] Briefly, the leukocyte-rich plasma was layered on the Ficoll isopaque gradient and centrifuged for 30 min at 4°C. In the pallet thus obtained, red blood cells were lysed by subjecting to osmotic shock lysis by using 0·87% chilled NH_4Cl for 15 s. Subsequently McCoy's double strength medium was added and centrifugation at 200×G for 5 min was done at 4°C. The pallet containing neutrophils was finally suspended in Minimum Essential Medium (MEM) without indicator at pH 7·2.

The viability of the cells (peritoneal macrophages and blood neutrophils) was checked using the Trypan blue exclusion method Tennant[16] and the final concentration of the cells was adjusted to 2×10^6/ml.

CHEMILUMINESCENCE ASSAY

The chemiluminescence (CL) response of blood neutrophils and peritoneal macrophages was measured by the method of Cheung *et al.*[17] 10 μl of luminol (5 mg/ml of 0·1 N NaOH) was used as a chemilugenic probe for the amplification of luminescence and latex (20 μl)
Berthhold luminometer (Biolumat LB 9500C) adjusted at an integration mode and at 37°C. The results were expressed as counts per minute per million cells (cpm/10^6 cells).

PREPARATION OF RENAL BRUSH BORDER MEMBRANE VESICLES (BBMV)

The renal BBMV were prepared by the method of Malathi *et al.*[18] as modified by Turner & Moran.[19] Briefly, after decapsulation renal cortex was removed and suspended in homogenizing buffer. The tissue was homogenized for 10 min at full speed in a tissue homogenizer. The resulting homogenate was left on ice for 10 min with $CaCl_2$. After differential centrifugations the pallet obtained was suspended in the reconstitution buffer containing 300 mM mannitol, 1 mM Tris buffer at pH 7·5 and repeatedly passed through a 25 gauge needle. The vesicle preparation was finally incubated at 30°C for 15–20 min and then stored at 20°C until used.

ESTIMATION OF MALONDIALDEHYDE (MDA)

MDA was estimated by the method of Maridonneau *et al.*[20] The rate of formation of MDA, a thiobarbituric acid reactive substance, was assayed in renal BBMV spectrophotometrically at 535 nm after its extraction into butanol layer. 1,1,3,3-tetra ethoxypropane was used as standard. The amount of MDA formed was expressed as *n* mole/mg protein.

Proteins in the renal BBMV were estimated by the method of Lowry *et al.*[21]

ASSAY OF RENAL BBM ENZYMES

The biochemical assessment of the activity of enzymes known to be characteristic of a renal brush border membrane, namely alkaline phosphatase (AP), leucine aminopeptidase (LAP) and γ-glutamyl transpeptidase (γ-GT) was done by the methods of Bergmeyer *et al.*,[22] Goldberg & Rutenberg[23] and Naftalin *et al.*[24] respectively.

ASSESSMENT OF BACILLARY GROWTH

The footpads of mice were used to harvest acid-fast bacilli (AFB) as described by Desikan & Venkataramariah.[25]

STATISTICAL ANALYSIS

The statistical significance was calculated using students' *t*-test. All the values have been presented as mean ± standard deviation (SD) of triplicates.

Results

CHEMILUMINESCENCE RESPONSE OF PERITONEAL MACROPHAGES

A marked increase ($P < 0{\cdot}001$) was observed in the CL response of peritoneal macrophages at 3, 6 and 9 months in the infected group as compared to the control group. However, the CL response at 9 months was much less compared to that observed at 3 months (Figure 1).

A slight increase ($P < 0{\cdot}05$) in CL response of blood neutrophils was observed in the infected group (751·28 ± 33·04) as compared to the control group (698·87 ± 42·43) only at 6 months (Figure 2).

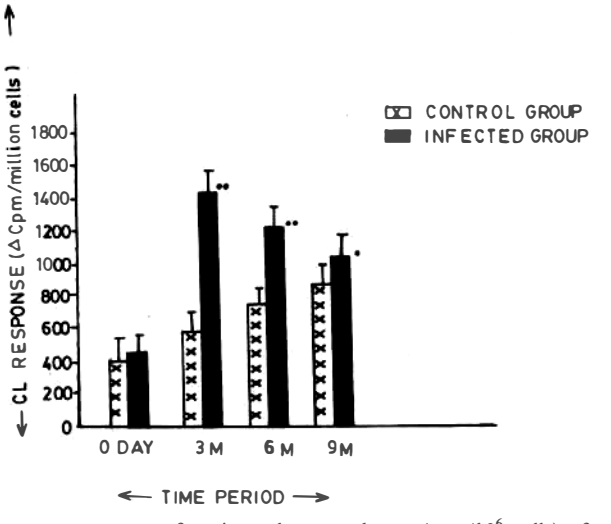

Figure 1. Chemiluminescence response of peritoneal macrophages (cpm/10^6 cells) of control and infected groups at 0 day, 3, 6 and 9 months postinfection.

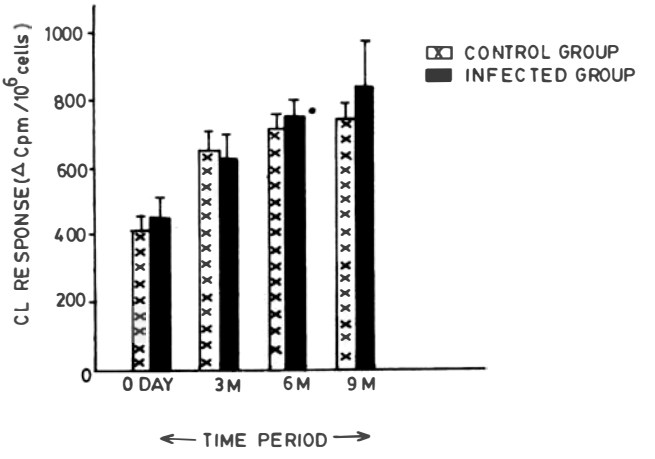

Figure 2. Chemiluminescence response of blood neutrophils (cpm/10^6 cells) of control and infected groups at 0 day, 3, 6 and 9 months postinfection.

MALONDIALDEHYDE PRODUCTION

A significant increase ($P < 0{\cdot}001$) was found in MDA at 3 and 6 months as a result of *M. leprae* infection in the infected group as compared to the control group (Figure 3).

ACTIVITY OF BBM ENZYMES

Activity of alkaline phosphatase

The enzyme activity in the infected group was found to be decreased significantly at 3 ($P < 0{\cdot}01$), 6 ($P < 0{\cdot}001$) and nine months ($P < 0{\cdot}001$) when compared to the control groups (Figure 4).

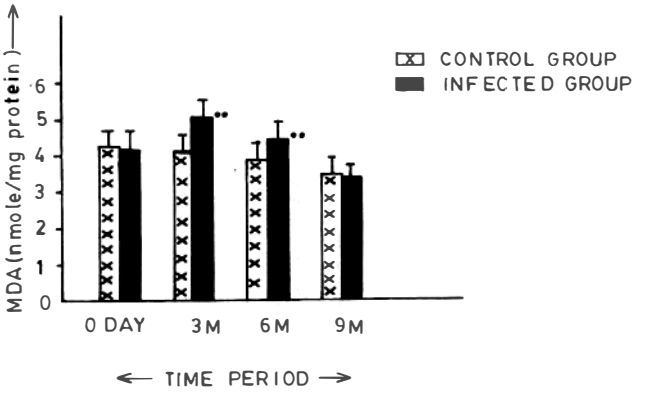

Figure 3. Malondialdehyde content (*n* moles/mg protein) in brush border membrane vesicles from kidneys of control and infected groups at 0 day, 3, 6 and 9 months postinfection.

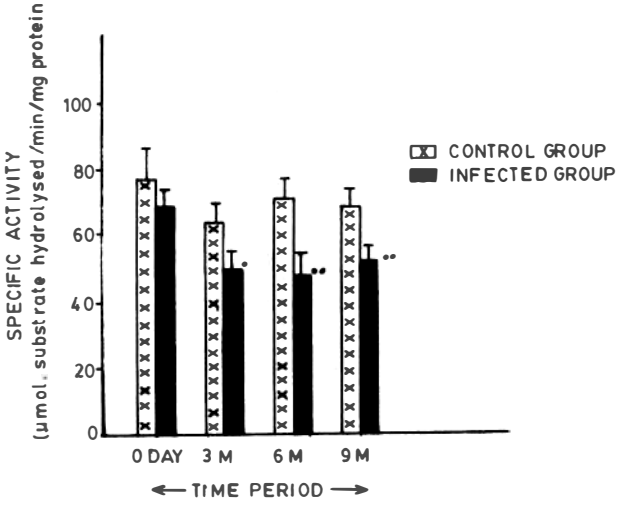

Figure 4. Specific activity of alkaline phosphatase in renal brush border membrane vesicles at 0 day, 3, 6 and 9 months postinfection.

Activity of Leucine aminopeptidase

A significant decline in the activity of this enzyme was observed in infected groups at 3 ($P < 0{\cdot}01$), 6 ($P < 0{\cdot}001$) and 9 months ($P < 0{\cdot}01$) as compared to their control groups (Figure 5).

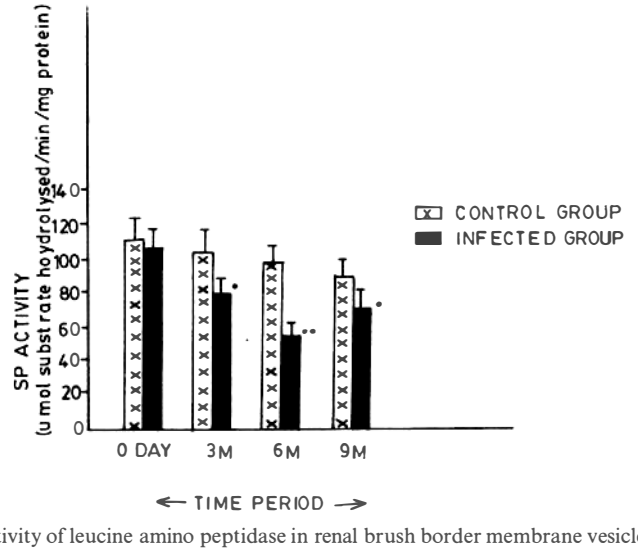

Figure 5. Specific activity of leucine amino peptidase in renal brush border membrane vesicles at 0 day, 3, 6 and 9 months postinfection.

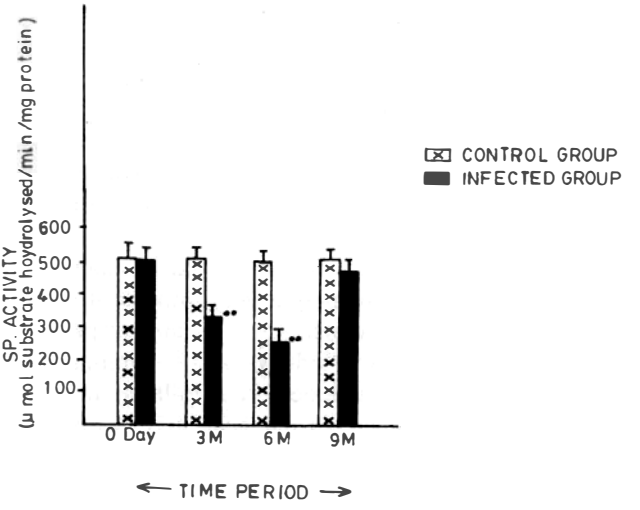

Figure 6. Specific activity of γ-glutamyl transpeptidase in renal brush border membrane vesicles at 0 day, 3, 6 and 9 months postinfection.

Activity of γ-glutamyl transpeptidase

A marked decrease ($P < 0{\cdot}001$) in the enzyme activity was observed in the infected group at 3 and 6 months as compared to the control groups. However, at 9 months, no significant difference was observed in the activity of this enzyme between infected and control groups (Figure 6).

BACTERIAL FOOTPAD COUNTS

The bacterial footpad counts were found to follow the characteristic patterns of growth after inoculation with *M. leprae*. The bacterial footpad counts increased linearly from 3 to 6 months from $0{\cdot}892 \times 10^4 \pm 0{\cdot}36 \times 10^4$ to $2{\cdot}45 \times 10^5 \pm 0{\cdot}92 \times 10^5$ reaching a stationary phase of growth at the end of 9 months when the counts were $2{\cdot}28 \times 10^5 \pm 0{\cdot}23 \times 10^5$.

Discussion

The results of the present study show that there is an increase in chemiluminescence response at 3, 6 and 9 months postinfection with *M. leprae*. The response was maximum at 3 months. The ROS production showed a good correlation with peak bacterial counts in the mouse footpads. The bacterial footpads pattern showed a linear increase from 3 to 6 months postinfection, representing the logarithmic phase of organism. However, at 9 months postinfection, stationary phase of bacillary growth is reached. The higher ROS production as indicated by CL response could be due to bacterial load which lead to greater stimulation. Brett & Butler[26] observed higher monocyte/macrophage activation in the BALB/c strain of mice which is susceptible to *M. lepraemurium* infection than C57 BL strain of mice which are resistant to infection. Our results indicate that there is an

increased production of ROS initially on stimulation as indicated by CL response but later some other suppressor mechanisms start acting, making the production of ROS inactive. This could be due to an increase in the bacterial load.

Our results indicate no significant increase in the CL response of blood neutrophils at 3 and 9 months and a slight increase was observed at 6 months only. This could be due to the fact that although neutrophils are phagocytic and constitute the first line of defence, they are conspicuous by their absence in the typical lesions of leprosy.

In cell-mediated immunity, prominent role is played by macrophages. Macrophage functions and their immune mechanisms play a very important role in the spectrum of leprosy throughout. Macrophages also constitute a prominent part of renal lesions as is evident by histopathological alterations in kidneys of these animals at 3, 6 and 9 months postinfection with *M. leprae* (data not included). The inflammatory cells in renal lesions consisted chiefly of mononuclear cells, plasma cells and lymphocytes. To study the chemiluminescence response of phagocytes, in the present study blood neutrophils and peritoneal macrophages were used. This indirect approach was adopted because of the difficulties in harvesting an adequate number of blood monocytes and renal macrophages.

The observed increase in MDA levels in the infected group at 3 and 6 months reflects increased lipid peroxidation. These two parameters (CL response and MDA production) are well correlated, thereby demonstrating that tissue damage is due to ROS at 3 and 6 months.

ROS can cause lipid peroxidation and disrupt membrane functions. The decrease in the activities of enzymes indicating renal damage, was found to correspond to the increased levels of MDA. A positive correlation between the two demonstrated that the tissue damage might be a direct consequence of lipid peroxidation. Lipid peroxidation have been shown to produce various toxic effects on cell structure as well as function including changes in membrane fluidity, permeability and loss of membrane integrity, protein degradation and ultimately cell lysis[27]. As a result of lipid hydroperoxide formation in membranes, damage to the membrane structure[9,10] and inactivation of membrane-bound enzymes[11,12,28] could result. The activities of various BBM enzymes have been reported to be decreased in the renal BBM during pyelonephritis and could be used as biochemical markers of tissue injury or the disease.[29] The activities of renal BBM enzymes have also been found to decrease in experimental leprosy. This has been further confirmed by altered transport of nutrients across renal brush border membrane in experimental leprosy.[30]

Although the effects seen in the mouse model are very transient, these might form a nidus for further damage in this infection. The ROS production might play a role in renal damage at early stages of *M. leprae* infection. In the later stages, other immunological mechanism may overpower the effect of ROS.

In human lepromatous leprosy, the secretion of renal brush border enzymes, namely alkaline phosphatase, leucine aminopeptidase and r-glutamyl transpeptidase has been reported.[31] It appears that the damage to renal tubules is caused by *M. leprae* or immune complexes leading to the shedding of these enzymes in the urine. The findings of increased secretion might be helpful in the early detection of renal involvement in leprosy patients and may possibly serve as an indicator of the response to multidrug therapy or a relapse in treated patients, as the present paper shows that these might be operative at a renal level.

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Relapse with multibacillary leprosy caused by rifampicin sensitive organisms following paucibacillary multidrug therapy

D. J. SOARES*, K. NEUPANE* & W. J. BRITTON†
**Anandaban Leprosy Hospital, PO Box 151, Kathmandu, Nepal; and †Department of Medicine, University of Sydney, NSW 2006, Australia*

Accepted for publication 6 January 1995

Summary Many leprosy patients treated with multidrug therapy (MDT) had previously received dapsone (DDS) monotherapy for many years. We report here 2 such patients treated with modified paucibacillary MDT composed of rifampicin and DDS who subsequently relapsed with multibacillary leprosy 5 and 6 years after release from treatment. Isolates of *Mycobacterium leprae* from both patients were resistant to DDS but sensitive to rifampicin, suggesting that the relapses were caused by rifampicin sensitive 'persister' organisms. The implications of this for surveillance of patients released from treatment (RFT) and the management of relapsed patients is discussed.

Introduction

The introduction of MDT[1] has been a major advance in the treatment of leprosy. The implementation of MDT was stimulated by the increasing prevalence of secondary DDS resistance in previously-treated patients and the emergence of primary DDS resistance, caused by the transmission of drug resistant organisms. Nordeen[2] has estimated the relapse rates to be 0·12% per year for PB cases and 0·22% per year for MB cases in groups of previously-treated and untreated patients. However, relapse with lepromatous leprosy may only occur 5–10 years after the cessation of either monotherapy with dapsona[3] or various forms of MDT.[4] Therefore such cases may only become apparent years after the implementation of MDT, and it is important to determine patterns of drug sensitivity of responsible *Mycobacterium leprae* bacilli.

Case report 1

A 20-year-old female first presented in 1969 with ulceration under the second metatarsal head of the right foot. There was sensory loss on both soles and both lateral popliteal nerves were readily palpable. Skin ulceration was present on the hands. A single

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Table 1

	Case 1	Case 2
Initial presentation	1969	1964
Initial smear	1·0+	1·5+
Low dose DDS	Yes	Yes
Modified PB–MDT	1983	1983
Relapse year	1989	1990
Relapse smear	5·0+	4·5+
PGL1-Ab	0·690	0·345
DDS resistance	Low (0·0001%)	High (0·01%)
Rifampicin	Sensitive	Sensitive

anaesthetic patch with a shiny atrophic surface was present on the right shin. Initial skin smears from the left and right back were positive, with a bacillary index (BI) of 1 +. Skin smears were negative elsewhere. In accordance with the 1969 practice, she was started on low dose DDS (25 mg weekly), which was then gradually increased to 50 mg twice a week for 4 years, and then 100 mg twice a week for 1 year. Daily DDS was then commenced at 25 mg per day, increasing to 100 mg per day by 1979, 10 years after the initial diagnosis. DDS was continued at this dosage until 1983. Clinical examination then revealed no skin lesions of thickened palpable peripheral nerves; however, there was extensive chronic neuropathic damage with right ulnar and median nerve palsy, left ulnar nerve palsy, clawing of the left toes and anaesthesia of both feet. Repeated skin smears since 1969 had been negative. In 1983, when MDT was introduced, the patient was reassessed. She was considered to have inactive borderline–tuberculoid leprosy and was started on modified PB–MDT. This consisted of rifampicin 600 mg on 2 consecutive days per month and dapsone 100 mg daily for 6 months from October 1983 to March 1984. She was then released from treatment and on subsequent reviews in 1987 and 1988 was well, with negative skin smears.

In April 1989, new erythematous raised well-defined skin lesions developed on her face, chest and shoulders (see Table 1 for results). Skin smears from the lesions were strongly positive with BI 5+. Histopathology of the lesion revealed borderline lepromatous leprosy with a BI of 4 + and a morphological index (MI) of 2·0%.

MB–MDT was commenced with monthly rifampicin 600 mg and clofazimine 300 mg and daily DDS 100 mg and clofazimine 50 mg. After 61 regular doses there was resolution of the skin lesions, and a fall in the mean BI from 4·5 + to 0·0 +. The patient has now been RFT.

Case report 2

A 31-year-old male first presented in December 1964 with an anaesthetic patch on his right knee but no peripheral nerve damage. Skin smears from routine sites were positive with a mean BI of 1·5 +. He commenced low dose DDS therapy, 25 mg per week, increasing to 50 mg per week. After 3 years of irregular therapy his skin smears were still positive with a mean BI of 1 +. After 2 further years of DDS therapy at 25 mg twice a week, the skin smears became negative. He continued DDS 50 mg daily for the next 13

years; however, he was very irregular, missing at least 3 years of therapy. Over this period the skin smears remained negative, there were no signs of active disease and he was subsequently released from treatment in December 1982. In September 1983 following the introduction of MDT he was started on a course of modified PB–MDT. Over 6 months he received supervised domiciliary rifampicin 600 mg twice a month and DDS 100 mg daily. He remained asymptomatic with negative skin smears and was released from treatment.

In September 1989, 6 years later, there were no clinical signs of activity on clinical review, but 12 months later in October 1990, he re-presented with ulceration of both hands. Examination revealed diffuse cutaneous infiltration, enlarged bilateral ulnar and lateral popliteal nerves and anaesthesia of both hands with secondary ulceration. Skin smears were positive with a mean BI of 4·5 + and an MI of 4 + (see Table 1 for results).

Skin biopsy was performed for mouse footpad inoculation and *M. leprae* was isolated after 7 months growth. The isolate was resistant to high dose DDS (0·01%) with growth in 3/10 footpads and were fully sensitive to rifampicin with no growth occurring in 10/10 footpads of mice receiving 0·05% rifampicin by gastric lavage.

The patient was recommenced on MB–MDT with rifampicin 600 mg and clofazimine 300 mg once per month and DDS 100 mg and clofazimine 50 mg daily. In addition, ofloxacin 400 mg daily was given for 14 days. After completing 26 doses of MDT, the skin lesions had resolved, and the mean BI had fallen from 4·5 + to 2·0 +.

Discussion

Relapse after MDT has been previously observed within leprosy control programmes in Nepal. van Brake *et al.*[5] documented relapse rates of 7·3 per 1000 per annum in PB and 4 per 1000 per annum in MB leprosy. A cause of relapse was the misclassification of MB leprosy patients as PB, resulting in inadequate chemotherapy. Both these patients were considered to have treated BT leprosy and so were given modified PB–MDT which included 12 doses of rifampicin 600 mg over 6 months. The initial WHO–MDT recommendations included skin-smear positive BT in the PB treatment group and Case 1 may have been an example of this category. Case 2, however, was probably BL leprosy when seen in 1964 because skin smears from routine sites were positive.

Under the revised WHO guidelines both would now be given MB–MDT, because all patients with any positive skin smear, regardless of classification, are considered as multibacillary leprosy sufferers.[6] There have been few reports of drug sensitivity patterns in patients relapsing after MDT. The DDS resistance of both these isolates was due to the prolonged low dose DDS therapy the patients received in the 1960s and 1970s. However, despite receiving rifampicin for 6 months, both isolates were fully rifampicin sensitive. As the bacillary load at the time PB–MDT was administered would have been very low, it is unlikely that these patients would develop rifampicin resistance. This suggests that relapse was due to proliferation of the few 'persister' organisms which had been metabolically dormant during the period of PB–MDT and had not developed rifampicin resistance.

The presence of 'persisters' after DDS monotherapy is well documented. More pertinently, during the THELEP drug trials, persisting *M. leprae* bacilli were detected in 9% of all patients, irrespective of the regimen or duration of MDT. Recently relapse

with fully sensitive organisms was reported in a patient 52 months after receiving an intensive course of MDT including daily rifampicin for 24 months.[7] Drug-sensitive persister organisms were implicated as the cause. This contrasts with the pattern of relapse observed after rifampicin monotherapy for active DDS-resistant leprosy when 22/39 of the isolates from MB relapses were rifampicin resistant.[8]

These cases highlight a number of issues concerning the implementation of MDT. First, all patients with past or present evidence of skin smear positivity should be assigned to MB–MDT. Second, even in the presence of pre-existing DDS resistance, the organisms responsible for multibacillary relapse may retain sensitivity to rifampicin. Third, relapse with rifampicin sensitive persister organisms may occur more than 5 years after release from treatment. This emphasizes the need for surveillance of MB patients up to 10 years after the completion of MDT. This will ensure that any patients with MB relapse are promptly treated and do not act as a source for the continuing spread of leprosy in the community.

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Lagophthalmos in a multibacillary population under multidrug therapy in the People's Republic of China

PAUL COURTRIGHT*, SUSAN LEWALLEN†, HUAN-YING LI‡, LU-FANG HU§ & JIAN-WEN YANG§

**Department of Ophthalmology, University of British Columbia, St Paul's Hospital, 1081 Burrand Street, Vancouver, BC, V6Z 1Y6 Canada; †3720 Harrison Street, Bellingham, WA 98226 USA; ‡Beijing Institute of Tropical Medicine, Beijing, Peoples Republic of China; §Sichuan Institute of Dermatology, Chengdu, Sichuan, Peoples Republic of China*

Accepted for publication 23 March 1995

Summary Lagophthalmos may be the most common potentially blinding ocular condition in leprosy. The magnitude of the problem among multibacillary patients has not been determined. We sought to ascertain the magnitude of lagophthalmos in a multibacillary leprosy patient population under multidrug therapy (MDT) (both newly diagnosed and with a prior history of dapsone monotherapy) in China and assess factors associated with its presence. In a survey of 640 multibacillary patients 3·8% of the newly diagnosed patients and 10·2% of the patients with prior dapsone monotherapy had lagophthalmos. Corneal disease and vision loss were common in both groups. Poor compliance with MDT, duration between onset and diagnosis, and duration on dapsone monotherapy were associated with the presence of lagophthalmos.

Our findings suggest that there may be a threshold at which MDT must be maintained to prevent lagophthalmos. Early leprosy diagnosis and treatment would also lessen the incidence of lagophthalmos in these patients. The high proportion of lagophthalmos patients with corneal disease suggests that there has been inadequate eye care for these patients.

Introduction

Lagophthalmos may be the most common potentially blinding ocular condition in leprosy. There are few studies with sufficient sampling design to generate estimates of life-time incidence of lagophthalmos in either the pre-multidrug therapy (MDT) era or MDT era.[1] In the pre-MDT era results from surveys (with appropriate sampling) in Malaŵi[2] and Korea[3] demonstrated a prevalence of lagophthalmos of 3·1% and 22%, respectively. The Malaŵian population was young, primarily paucibacillary, and had a

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short duration of disease while the Korean population studied was older, primarily multibacillary, and had a long duration of disease. Brandt and colleagues suggested that antileprosy therapy (dapsone monotherapy) could reduce the incidence of lagophthalmos[4] although the contribution of disease type, duration of disease, and duration of chemotherapy was not determined.

Evidence from MDT treated patients in India[5] suggests that at least 2% of paucibacillary patients will develop lagophthalmos within 12 months of the onset of disease. The presence of a facial patch may be responsible for at least 85% of cases. Although lagophthalmos was not recorded in any of the paucibacillary patients in a recent survey of newly diagnosed patients in Nepal[6] the study sample was small ($n = 107$).

The magnitude of the problem of lagophthalmos among multibacillary patients is less clear. Prior to the introduction of MDT, evidence from Korea would suggest that the life-time incidence of lagophthalmos in multibacillary patients was at least 25%. In a survey of 1984 multibacillary patients (primarily 'cured' patients) in Jiangsu Province, China, 31% had lagophthalmos.[7] In the Nepal survey[6] 6% of multibacillary patients already had lagophthalmos at the time of their disease diagnosis.

We sought to determine the prevalence of lagophthalmos in a multibacillary patient population under MDT and to investigate the factors associated with its presence.

Materials and Methods

The study was carried out in Liangshan Yi Autonomous Region of Sichuan Province, People's Republic of China. Study methods have been described previously.[8] Briefly, this involved an assessment of leprosy-related eye conditions by leprosy paramedical workers trained to recognize ocular conditions using a previously tested criteria.[9] Lagophthalmos was defined as either mild (ability to close with forced pressure but not gentle, i.e. as in sleep) or moderate to severe (inability to close with forced pressure). For the purpose of this report these two groups have been combined. All 'active' leprosy patients in the region (except two remote counties) were examined. Active patients are defined as either patients newly diagnosed (since 1988 in all counties) and treated by MDT, or patients diagnosed as having leprosy prior to 1988 and on dapsone monotherapy until MDT was introduced in their county. Some active patients have completed the two-year MDT regimen and are under surveillance only. Clinical records of a systematic sample (every other patient) were extracted; clinical characteristics collected are given in Table 1. Compliance with MDT was considered good if 24 months of antileprosy therapy was completed within 36 months without any interruption of 3 months or more. As clinical charts were reviewed in a retrospective fashion, facial lesions were defined as either a lesion conclusively involving the lid or a lesion on the face: lid involvement unknown. Cured leprosy patients (released from treatment), which comprise 75% of the leprosy population in the region, were not included because of the lack of reliable clinical data.

For univariate data analysis Student's t-test values (separate variance estimates for those with unequal standard deviations) were calculated for continuous predictor variables and χ-square values (corrected for small sample sizes) for dichotomous variables. For multivariate analysis, Cox's proportional hazards model was used to generate a prevalence rate ratio adjusted for confounding.

Table 1. Characterstics included in study

Age
Gender
Ethnic group
Age at diagnosis
Kilometres to health centre or health worker
Bacteriologic index at diagnosis
Bacteriologic index at completion of multidrug therapy
Duration between onset and diagnosis
Deformity index at diagnosis
Deformity index at present
Deformity index for hands & feet at present
Facial lesions on face
Duration on dapsone monotherapy prior to MDT (only on patients with a history of dapsone monotherapy)
Compliance with MDT
Type 1 reactions during or after treatment
Type 2 reactions during or after treatment
History of previous dapsone monotherapy

Results

There were 640 multibacillary patients in the study; 208 (32·5%) were newly diagnosed (treated with MDT only) and 432 (67·5%) had a history of prior dapsone monotherapy. Good compliance with MDT was recorded in 97% and the median duration between disease onset and diagnosis in newly diagnosed patients was 24 months. Lagophthalmos was present in 44 patients (10·2%) with a history of prior dapsone monotherapy and in 8 patients (3·8%) who were newly diagnosed. Because of the hazards associated with the pooling of data from these two groups[8] we describe them separately.

NEWLY-DIAGNOSED LEPROSY PATIENTS

Lagophthalmos accounted for 35% of leprosy-related potentially blinding eye disease (defined as lagophthalmos, diminished corneal sensation, acute uveitis, or chronic uveitis) in these patients. Corneal disease (keratitis, ulcer, or opacity) was recognized in 87·5% of the patients with lagophthalmos compared to 2·0% of the patients without lagophthalmos, Table 2. Only 4 patients (1·9%) had a best-corrected vision (in the better eye) of <6/18; in three cases this was probably due to cataract. In the patients with lagophthalmos, 5 eyes (31·3%) had vision <6/18. In the patients without lagophthalmos only 6 eyes (1·5%) had a vision <6/18.

Two of the four patients in whom poor compliance with MDT was reported had lagophthalmos. In patients in which good compliance was recorded the prevalence of lagophthalmos was 3·0% (Fisher's exact test p value = 0·007). Lagophthalmos was slightly more frequent in patients in whom facial lesions were recorded than in patients without facial lesions. Patients with lagophthalmos had a lower bacteriologic index at start of MDT (mean = 2.2, standard deviation = 1·1) compared to patients without lagophthalmos (mean = 3·0, standard deviation = 1·1). (Student's t test $p = 0·06$).

Table 2. Characteristics associated with the presence of lagophthalmos. Newly diagnosed leprosy patients

	Lagophthalmos	
	Present No. (%)	Absent No. (%)
Visual acuity (better eye)		
<6/18	1 (12·5)	3 (1·5)
⩾6/18	7 (87·5)	197 (98·5)
Corneal disease		
Present	7 (87·5)	4 (2·0)*
Absent	1 (12·5)	196 (98·0)
Other leprosy-related deformities		
Present	5 (62·5)	82 (41·0)
Absent	3 (37·5)	118 (59·0)
Facial involvement		
Lid involvement noted	4 (50·0)	93 (46·5)
Lid involvement possible	3 (37·5)	50 (25·0)
No facial involvement	1 (12·5)	57 (28·5)

* Fishers exact (two-tailed) p value <0·001.

PATIENTS WITH A PRIOR HISTORY OF DAPSONE MONOTHERAPY

Lagophthalmos accounted for 46·8% of the eye disease in these patients. Corneal disease was recognized in 68·2% of patients with lagophthalmos and in 3·1% of patients without lagophthalmos; Table 3. Poor vision (<6/18 in the better eye) was recorded in 4·2% of this group. Cataracts probably accounted for 44·4% of the poor vision in patients with a

Table 3. Characteristics associated with the presence of lagophthalmos. Patients with a prior history of dapsone monotherapy

	Lagophthalmos		
	Present No. (%)	Absent No. (%)	Odds Ratio (95% CI)
Visual acuity (better eye)			
<6/18	7 (15·9)	11 (2·8)	6·5 (2·1, 19·5)*
⩾618	37 (84·1)	377 (97·2)	
Corneal disease			
Present	30 (68·2)	12 (3.1)	67·1 (26·5, 174·9)*
Absent	14 (31·8)	376 (96·9)	
Other leprosy-related deformities			
Present	41 (93·2)	220 (56·7)	10·4 (3·0, 42·9)*
Absent	3 (6·8)	168 (43·3)	
Facial involvement			
Lid involvement noted	18 (40·9)	164 (42·3)	1·3 (0·5, 2·9)
Lid involvement possible	15 (34·1)	97 (25·0)	1·8 (0·7, 4·4)
No facial involvement	11 (25·0)	127 (32·7)	1·0†

* Chi-square (with Yates correction) p value <0·001.
† Reference group.
CI, Confidence interval.

Table 4. Selected characteristics associated with the presence of lagophthalmos in patients with a prior history of dapsone monotherapy

	(Standard deviation)	Risk of lagophthalmos Odds ratio (95% confidence interval)	
		Unadjusted	Adjusted
Age of patient (years)			
Lagophthalmos present	49·5 (9·96)***	1·03 (1·01, 10·4)**	1·01 (0·99, 1·03)
Lagophthalmos not present	43·5 (1·85)		
Duration of monotherapy (years)			
Lagophthalmos present	10·2 (8·83)**	1·04 (1·01, 1·07)**	1·03 (1·01, 1·06)**
Lagopthalmos not present	6·0 (6·06)		
Duration between onset & diagnosis (months)			
Lagophthalmos present	99·0 (115·1)**	1·01 (1·01, 1·02)***	1·01 (1.01, 1·02)***
Lagophthalmos not present	64·9 (76·1)		
Bacteriologic index at end of treatment			
Lagophthalmos present	0·10 (0·31)*	0·89 (0·81, 0·99)*	0·92 (0.84, 1·02)
Lagophthalmos not present	0·29 (0·56)		

Statistical significance measured at: *$p < 0{\cdot}05$, **$p < 0{\cdot}01$, ***$p < 0{\cdot}001$.

prior history of dapsone monotherapy. In the patients with lagophthalmos 17 eyes (19·3%) had a vision of <6/18 while in the patients without lagophthalmos only 19 eyes (2·4%) had a vision of <6/18. Factors associated with the presence of lagophthalmos are shown in Table 4. Multivariate analysis demonstrated that only duration on monotherapy and duration between onset of disease and diagnosis were independently associated with the presence of lagophthalmos.

Discussion

With good case-finding and good case control it is encouraging that lagophthalmos was recognized in only 3·8% of the newly diagnosed multibacillary patients. This does not reflect the cumulative incidence of lagophthalmos as adequate steroid therapy during reactions may have resulted in a resolution of lagophthalmos in some cases.[10] Furthermore, there is a possibility that some patients will develop lagophthalmos after the completion of MDT. The small number of newly diagnosed patients with lagophthalmos in our study limits our ability to investigate characteristics that contribute to lagophthalmos in these patients. Nevertheless, the fact that lagophthalmos was found in two of the four patients in which poor compliance was recorded suggests that there may be a threshold at which MDT must be maintained to prevent lagophthalmos from developing.

Comparing the patients with a prior history of dapsone monotherapy to newly diagnosed patients provides some additional information. We cannot evaluate the duration of lagophthalmos; some of the patients with a prior history of dapsone monotherapy probably had lagophthalmos on diagnosis of leprosy as the duration between onset and diagnosis in these patients was 82 months, considerably longer than the newly diagnosed patients. Our data suggest that some of the bacteriocidal qualities of

MDT, not found in (bacteriostatic) dapsone, reduce the propensity for damage to the orbicularis oculi. Interestingly, duration of dapsone monotherapy (evidence of insufficient antileprosy therapy) and duration between onset and diagnosis (evidence of prolonged periods in which *Mycobacterium leprae* proliferate) are independent contributors to the presence of lagophthalmos in patients with a prior history of dapsone monotherapy.

The low bacteriologic index found in patients with lagophthalmos may reflect an increased cellular response by these patients. The independent contribution of facial involvement, reversal reactions, and cellular immunity in multibacillary patients cannot be sufficiently evaluated in our study population.

It was disturbing to find that even among newly diagnosed patients a large proportion of the lagophthalmos patients had corneal disease and that vision loss was common. At the time of the survey, surgical correction of lagophthalmos was not available to leprosy patients in Liangshan. While we do not have the knowledge and skills to prevent lagophthalmos from developing (other than early and adequate treatment) corneal disease and vision loss may be prevented by adequate surgical correction of lagophthalmos. Lagophthalmos need not be a significant contributor to corneal disease and blindness in leprosy.

Acknowledgments

The China Leprosy Eye Care Project has been supported by Project ORBIS and the Ministry of Public Health, China. Their assistance is greatly appreciated.

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Lepr Rev (1995) **66,** 220–223.

Current concepts in the surgical management of lagophthalmos in leprosy

PAUL COURTRIGHT* & SUSAN LEWALLEN†
**Department of Ophthalmology, University of British Columbia, St Paul's Hospital, 1081 Burrard Street, Vancouver, BC V6Z 1Y6 Canada; and †3720 Harrison Street, Bellingham, WA 98226, USA*

Accepted for publication 23 March 1995

Summary Existing data suggest that, at a minimum, 2% of paucibacillary patients and 5% of multibacillary patients have lagophthalmos; at least 290,000 people worldwide have leprosy-related lagophthalmos. Surgical intervention is the only method for correcting lagophthalmos; effectiveness of the different procedures commonly used has not been measured. Results from a survey of eye care providers revealed that surgeons in Asia used a wide range of different techniques for the correction of lagophthalmos while almost all of the surgeons in Africa used tarsorrhaphy. There is a need to evaluate surgical outcome of these techniques and to develop guidelines to assist in increasing the number of surgeries for lagophthalmos in leprosy patients.

Introduction

Tremendous strides in multidrug therapy (MDT) coverage have been made over the past two decades; in 1992 it was estimated that about 55% of registered leprosy patients were under MDT.[1] Deformity prevention and management (particularly related to ocular disease) have been more difficult to achieve.

Estimating the number of leprosy patients with lagophthalmos is problematic. Nevertheless, existing data suggest that, at a minimum, 2% of paucibacillary patients[2] and 5% of multibacillary patients[3] have lagophthalmos. Using estimates of total leprosy patients (including those released from treatment) it can be calculated that at least 290,000 people worldwide have leprosy-related lagophthalmos. Lagophthalmos is a serious complication of leprosy; corneal disease and vision loss are common. The stigmatizing characteristics of lagophthalmos are also significant. Prevention, the purview of general medical/paramedical personnel, should be the primary method for controlling lagophthalmos. For paucibacillary patients the early recognition of facial patches and adequate steroid treatment of reversal reactions[4] are the most effective tools in the prevention of lagophthalmos. In multibacillary disease early and adequate antileprosy therapy will prevent lagophthalmos from developing in many cases.[3]

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However, until these measures are achieved and all patients are on MDT, lagophthalmos will continue to be a significant cause of ocular morbidity in leprosy.

Surgical intervention is the only method for correcting lagophthalmos and preventing corneal disease and vision loss. Recommendations for surgical intervention are not straightforward. There are a number of different surgical procedures for the correction of lagophthalmos and there is conflicting evidence on their effectiveness; these must also be evaluated in the context of available resources.

In a review of 33 temporalis transposition surgeries (in 22 patients) in Pakistan Weber *et al.*, report that 51·5% did not have a 'good result' based on the physical findings and patients' opinion.[5] Betharia and Bhaumik in India reviewed the outcome of 10 eyes with surgical correction by a modified Kuhnt Szymanowski operation and 10 eyes with a facial sling.[6] In both groups 8 or more patients had cosmetic improvement; further evaluation is impossible due to the small number of patients. An evaluation of the sling procedure in 54 eyes in China demonstrated 'good' or 'excellent' results in 63% of cases after a 2–6 month postoperative follow up (Lu Bin-xin, personal communication).

We sought to determine the frequency of use of common surgical procedures for lagophthalmos among ophthalmologists and other eye care providers treating leprosy patients, and the usual criteria used for the selection of patients for surgery.

Materials and methods

A questionnaire was distributed (through ILEP, Christoffel Blindenmission and by direct mail) to leprosy ophthalmologists and leprosy institutions worldwide. The questionnaire included questions related to patient population, number of surgeries performed, surgical procedure(s) used, criteria for selection of patients for surgery, and criteria for selection of surgical procedures.

There have been a profusion of names applied to surgical procedures for lagophthalmos which work on the same principle, but differ in slight ways. For our review we tried to classify all procedures into one of four groups which included:

1 Temporalis transfer. A part of the temporalis muscle is transferred to the eyelids so that use of the jaw causes the lids to close. This complex procedure requires physical therapy for success and has a good cosmetic result.
2 Tarsorrhaphy. This includes any method which permanently closes part of the eyelid margin temporally and sometimes nasally as well. This simple procedure does not require physical therapy for success but often does not result in a good cosmetic effect.
3 Lid suspension. This refers to any operation in which some material, e.g., nylon suture, fascia lata, is placed on the lid margin in order to raise the lid margin by resuspending it. This procedure is of moderate complexity, requiring no physical therapy for success and has a good cosmetic effect.
4 Horizontal shortening. This refers to any one of the many procedures which works by removing a piece of lid (shortening the lid in the horizontal direction) usually at the lateral canthal angle. Modifications are referred to as the tarsal strip, modified Kuhnt Szymanowski, Fox, or Bick procedure. This procedure is of moderate complexity, requiring no physical therapy for success and has a good cosmetic effect.

Table 1. Common surgical procedures used for the correction of lagophthalmos: frequency of reporting

	Reported use		
Surgical procedure	Asia ($n = 14$)	Africa ($n = 8$)	Overall ($n = 27$)
Horizontal shortening	64·3%	0%	42·3%
Temporalis transfer	57·1%	0%	38·5%
Tarsorrhaphy	64·3%	100%	76·9%
Lid suspension	14.3%	0%	7·7%

Results

Twenty-seven completed forms were received; most were from clinicians working in Asia or Africa. Overall, the median proportion of leprosy patients undergoing surgical correction of lagophthalmos in the sites was 0·2%. The most commonly reported procedure used for correction of lagophthalmos was tarsorrhaphy (Table 1). Surgeons in Africa relied on this procedure almost exclusively while surgeons in Asia reported using tarsorrhaphy, horizontal shortening and TMT almost equally. Degree of corneal exposure, corneal damage, and ectropion (but not corneal hypesthesia) were commonly reported indications for surgery (Table 2).

Discussion

The best surgical procedure for the correction of lagophthalmos would have the following characteristics:

1 It could be performed by a trained health worker in the field instead of by an ophthalmologist in a hospital.
2 It would require minimal instruments and supplies and little time to perform.
3 It would not require any preoperative or postoperative physical therapy.
4 It would give a good cosmetic result and lead to high patient satisfaction.
5 It would give a long-term solution, not requiring any additional surgery.
6 It would prevent the development of corneal damage due to corneal exposure.

Clearly, none of the commonly-used surgeries for lagophthalmos fit all of these

Table 2. Criteria for the selection of patients for lagophthalmos surgery

Criteria	% of respondents reporting*
Exposure of cornea	72%
Ectropion	64%
Corneal damage	72%
Corneal hypesthesia	28%

* Multiple criteria could be selected by respondents.

characteristics; this explains some of the wide variation in use of different procedures worldwide. Interpretation of our results is limited by the lack of objective criteria for measuring success and failure with surgical correction. We do not claim to have a representative sample of clinicians; surgeons who returned the questionnaire were interested in the topic. Nevertheless, the findings from this survey and recent publications suggest that there is a need for evaluating surgical correction of lagophthalmos in leprosy. There is a need to measure the outcome of tarsorrhaphy and horizontal shortening in the hands of health workers under routine field conditions. The high proportion of TMT patients with a poor result in Pakistan (and anecdotal reports elsewhere) suggests that a scientific evaluation of TMT patients in other settings is needed as soon as possible. If TMT does not offer adequate long-term results in these patients it should be discontinued. Objective criteria for targeting patients in need of surgery are needed. Training programmes for health workers need to be developed and standardized. Educational programmes aimed at motivating patients to demand surgery need to be developed. These activities should assist health workers in reducing ocular disability due to lagophthalmos.

Acknowledgments

We would like to thank ILEP, Christoffel Blindenmission and the respondents for their cooperation in this survey.

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Lepr Rev (1995) **66,** 224–228.

Repeatability of nerve thickness assessment in the clinical examination for leprosy

C. KOLAPPAN,* R. SELVARAJ,
ABDUL KHUDOOS, B. N. APPE GOWDA,
MANJULA DATTA & R. PRABHAKAR
Tuberculosis Research Centre, Epidemiology Unit, Tamil Nadu, India

Accepted for publication 2 December 1994

Summary The assessment of the thickness of the superficial peripheral nerve trunks to document nerve involvement is an important aspect of clinical examination in case finding for leprosy, and is usually done by trained paramedical workers (PMWs). This assessment is subject to variability and has implications on the outcome of the survey. The present study proposes to quantify this variability. In this study, 242 individuals, consisting of 50 neuritic cases, 143 nonneuritic cases of leprosy and 49 normal controls, selected from the records of the trial of BCG prophylaxis in leprosy in South India, were examined by a doctor and paramedical workers. Repeatability of nerve thickness assessment for ulnar and popliteal nerves between the medical officer (MO) and the PMWs was quantified using Kappa statistics. The Kappa values for repeatability between the MO and the PMWs ranged from 0·45 to 0·54 and 0·52 to 0·69 for ulnar and popliteal nerves, respectively. The implications of the variability in nerve assessment are discussed.

Introduction

Leprosy surveys very often employ trained PMWs for screening the population. The MO examines the individuals diagnosed by the PMWs as having leprosy for confirmation. The clinical examination for the diagnosis of leprosy includes the palpation of superficial peripheral nerve trunks, especially the ulnar and popliteal nerves in order to assess their thickness. The proper assessment of nerve thickness is essential for the diagnosis and classification of disease. The clinical examination by palpation is the only way to diagnose nerve thickening and, in neuritic leprosy, the assessment of nerve thickening is often the only means of diagnosis.

Since the clinical assessment of nerve thickness is not based on objective criteria, variability between 2 assessors or the same assessor at 2 different times could be

* Correspondence: Tuberculosis Research Centre, Epidemiology Unit, Madras 600 031, India.

0305-7518/95/066224+05 $1.00

expected. Neuritic leprosy constitutes about 14% of the prevalent cases of leprosy.[1] But the proportion of leprosy patients with peripheral nerve trunk involvements will be much higher. Therefore the variability in clinical assesment of nerve thickening is likely to have a considerable influence on the estimates of prevalence rates so obtained. This study presents an attempt to actually quantify this variability.

Materials and methods

Since the prevalence of thickened nerves among the general population is very low, the study sample is selected to include a fair proportion of individuals with thickened nerves. We selected 242 subjects, consisting of 50 (21%) patients with neuritic leprosy, 143 (59%) with nonneuritic leprosy and 49 (20%) normal controls, from the records of the South Indian Chingleput trial of BCG prophylaxis in leprosy. The assessment of repeatability was carried out between 8 PMWs and 1 MO who were engaged in the BCG Prophylaxis Trial in leprosy and had at least 10 years experience in the clinical examination for leprosy. Out of the 244 selected, 242 were examined by the MO (2 were not available for examination). Following the examination by the MO of an individual, each of the 8 PMWs examined him/her independently. The interval between the MO and PMW examination for any individual varied between 0 and 7 days. The PMWs recorded their findings independently on a separate precoded sheet without knowing the findings of the other PMWs and the MO. Each single examination was independent of any other examination.

The findings of the clinical examination were recorded on the prescribed form in a precoded format for each individual. While assessing the nerves, both thickness and consistency were assessed and recorded.

STATISTICAL ANALYSIS

The measurement of interexaminer agreement

Suppose that each of a sample of n subjects is rated independently by 2 examiners on a categorical scale consisting of 2 categories:

		First examiner	
		Positive	Negative
Second examiner	Positive	a	b
	Negative	c	d

A measure of agreement is the mean pair agreement index P_0, which is obtained as

$$P_0 = \text{number of agreements/Total No. of pairs}$$
$$= (a + d) / (a + b + c + d)$$

This varies considerably with the prevalence. Any characteristic with a low prevalence will have a higher value for d and a higher repeatability, i.e. the value of P_0 is inflated. Thus it is clear that except in the most extreme circumstances some degree of agreement is to be expected by chance alone.

Let us consider an index that assumes the value 1 when there is complete agreement. Let P_0 denote the observed value of the index. Let P_e denote the value expected on the basis of chance alone.

The obtained excess beyond chance is $P_0 - P_e$, where the maximum possible excess is $1 - P_e$. The ratio of these 2 differences is denoted by Kappa (K) and is defined by

$$K = (P_0 - P_e)/(1 - P_e).$$

Kappa is a measure of a chance corrected agreement between 2 ratings. A value of '+ 1' for Kappa indicates complete agreement. A value of '0' implies agreement no better than chance. Negative values indicate more disagreement than expected by chance.

In this study, interobserver variations were measured using the Kappa statistic for the chance corrected agreement as described by Fliess[4]. This approach was preferred because of its ability to quantify the maximum possible agreement on abnormalities.

Results

In leprosy surveys and control programmes, PMWs are used for screening purposes only. Case diagnoses are made by MOs whose clinical examination is considered as standard. In this study the variability between the standard examiner (MO) and test examiner (PMW) was assessed for each of the 8 PMWs independently. The prevalences of thickened ulnar and popliteal nerves of the study population were 23% and 26%, respectively. The prevalences of altered consistency of the same nerves were 5·5% and 9·2%, respectively. Since the prevalences of altered consistency were low in the study population, the findings on consistency are not reported here. Table 1 shows the distribution of various categories of study population as seen by the MO and PMWs. The study population consisted of a reasonable mix of all types of leprosy in which nerve thickening could be expected. Table 1 shows the number of individuals examined by each PMW. The MO had examined 242 cases, out of which at least 212 had been examined by

Table 1. Distribution of the study population according to disease status

		Number examined by the PMWs							
Case category	MO	1	2	3	4	5	6	7	8
Maculo anaesthetic	35	30	30	31	31	29	29	31	30
Tuberculoid	17	16	16	16	15	16	15	15	16
Neuritic	50	44	49	50	48	49	49	49	47
Lepromatous	14	10	11	11	11	10	10	11	10
Borderline	49	39	43	43	41	41	41	43	40
Suspect	28	28	28	28	24	28	26	28	26
Normals	49	45	49	49	48	48	49	49	49
Total	242	212	226	228	218	221	219	226	218

Table 2. Interobserver agreement in the assessment of nerve thickening

PMW	No. of nerves assessed	Kappa Statistics: Ulnar nerve Kappa	(95% C I)	Popliteal nerve Kappa	(95% C I)
1	424	0·50	(0·40, 0·60)	0·69	(0·60, 0·79)
2	452	0·51	(0·41, 0·60)	0·57	(0·48, 0·66)
3	456	0·54	(0·45, 0·63)	0·59	(0·49, 0·68)
4	436	0·53	(0·44, 0·62)	0·56	(0·47, 0·65)
5	442	0·49	(0·40, 0·58)	0·54	(0·45, 0·63)
6	438	0·45	(0·36, 0·55)	0·55	(0·46, 0·64)
7	452	0·47	(0·38, 0·56)	0·58	(0·49, 0·67)
8	436	0·49	(0·40, 0·58)	0·52	(0·43, 0·61)

each PMW. Table 2 shows the Kappa statistics for ulnar and popliteal nerve thickness assessment between the MO and each PMW. It is seen that the Kappa values for the 8 PMWs for ulnar thickening ranged from 0·45 to 0·54. The corresponding ranges for popliteal nerve thickening was 0·52–0·69.

Discussion

The sample is selected in such a way that a satisfactory level of prevalence of study characteristics can be ensured in the study population. The study was also confined to nerve thickening, since this is the sign that will be used for case detection in the field, and therefore other signs such as nerve tenderness and sensory deficit were not looked for.

The repeatability of a qualitative measurement like the thickening of a nerve is dependent upon the 2 components of variability, namely the biological variability and measurement variability. Dr Noordeen[1] has reported spontaneous regression of thickened nerves in leprosy patients (biological variability). In the present study, the biological variability is minimized by having the paired examinations for each observer within 7 days. It is therefore reasonable to assume that the interobserver variation in this study is almost entirely due to the measurement variability. There is a certain inherent lack of precision in the method adopted for the assessment of nerve status. Obesity, occupation and the size of the corresponding nerve in the contralateral limb are the factors that influence the decision on nerve thickness status. Since the above-mentioned criteria are subjective in nature rather than objective, the repeatability as expressed by the Kappa statistic is not very good. Earlier studies[2,3] have studied the repeatability for the diagnosis of leprosy between MOs and between the MO and senior PMWs, respectively.

Neelan *et al.*[3] have studied the repeatability of diagnosis and classification of early lesion of leprosy among medical officers. They have not, however, studied the repeatability of nerve thickening assessment in that study. Gupte *et al.*[2] reported Kappa values (K—0.78) for agreement between 3 pairs of examinations for assessment of nerve thickness with sensory deficit. They had studied nerve thickening not in isolation but as a part of total clinical examination. However, they did not study ulnar and popliteal nerve

thickening separately as was done in this study. The objective of the present study was to view nerve thickening as a clinical sign by itself. Therefore a complete examination of the patients was not carried out and only their nerves were examined. This was expected to eliminate expectation bias due to knowledge of the case status of the individual. In the present study the Kappa values for ulnar thickening range from 0·45 to 0·54 and the popliteal thickening from 0·52 to 0·69. According to the classification of Landis & Koch[5] Kappa values of between 0·4 and 0·6 could be taken as moderate agreement. We note that agreement is better for popliteal thickening than for the ulnar thickening, but for both nerves it is still only moderate.

In view of the above findings, it would appear that one cannot expect more than a moderate level of reliability for a clinical examination undertaken by PMWs with respect to nerve thickening. However, standardizing PMWs and selecting those with high levels of interobserver agreement would minimize measurement errors, especially in rapid prevalence surveys.

Conclusion

The assessment of thickness of ulnar and popliteal nerves is an important aspect of routine clinical examination. Leprosy screening examination is usually carried out by trained PMWs. Each PMW acts as an independent screening test and the MO acts as the confirmatory standard test. In this study, the repeatability of nerve thickening assessment between the MO and the PMWs was studied. The study shows that the Kappa statistic for interexaminer repeatability varies between 0·45 and 0·69. The present study underlines the fact that this clinical sign (nerve thickening) assessed in the clinical examination for leprosy is a soft parameter and even experienced workers show considerable variability in its assessment. This may be kept in mind while assessing prevalence in large surveys.

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Lepr Rev (1995) **66,** 229–234.

Tibialis posterior transfer in the correction of footdrop due to leprosy

D. SOARES
Anandaban Leprosy Hospital, The Leprosy Mission, PO Box 151, Kathmandu, Nepal

Accepted for publication 27 March 1995

Summary In the correction of footdrop due to leprosy neuritis the tibialis posterior muscle is re-routed and used to provide dorsiflexion of the foot. This study of tibialis posterior transfer was carried out to compare the results of the circumtibial and interosseous routes. There is no significant difference in the range of motion between either route though the range of the interosseous route is more functional (better dorsiflexion). The interosseous route is preferable as this results in a significantly lower incidence of recurrent inversion deformity of the foot at long-term follow-up when compared with the circumtibial route.

Introduction

Footdrop due to the paralysis of the anterior tibial and peroneal muscles is found in 2–5%[10,16] of newly diagnosed leprosy patients as a result of leprosy neuritis.

Leprosy neuritis affects nerves where they are close to the skin and pass through a narrow fibro-osseous canal. In the lower limb this involves the lateral popliteal nerve around the neck of the fibula (leading to footdrop) and the posterior tibial nerve at the tarsal tunnel (leading to anaesthesia of the plantar surface). When both these nerves are damaged then the main impact during walking falls on the anaesthetic forefoot rather than the heel, with plantar trophic ulceration being the almost inevitable result. This study assesses the outcome of tibialis posterior transfer (TPT) in the correction of footdrop due to leprosy and specifically compares the circumtibial (CT) with the interosseous (IO) route.

Methods

One hundred and ten footdrop corrections in 95 patients (83 male and 12 female) on a total of 105 feet were followed-up. These were performed in the years 1987–93. Ten patients had bilateral corrections. Nine operations were redone when the earlier operation had failed, i.e. the patient developed recurrent inversion or footdrop

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persisted. For all patients, data was collected prospectively (pre-operative, immediately out of Plaster of Paris (POP) and discharge 'angles'). Final follow-up data (at least 6 months post-op) on recurrent inversion was available in 69 patients. This was carried out during 1994. In 59 (53·6%) of these patients 'angles' (measurement of active dorsiflexion (ADF) and active plantarflexion (APF)) and further data on recurrent ulceration and bone loss are also available.

Angle measurements for the foot were taken with neutral as 90° and 20° dorsiflexion as 70°. Inversion of more than 5° was considered as significant. Range of motion (ROM) was measured as active APF—active ADF.

Abbreviations used for some muscles include: tibialis anterior (TAN), extensor hallucis longus (EHL), extensor digitorum longus (EDL), peroneus brevis (PB), peroneus tertius (PT), tibialis posterior (TP).

Technique

The main details of technique for the IO route have been described elsewhere, however some important points need to be made. I routinely lengthen the tendo achilles by an open Z lengthening so as to enable easy passive dorsiflexion to at least 65°. It is important that the IO membrane is widely opened and that the TP is rerouted from the posterior compartment to the anterior compartment lateral to the wasted belly of TAN in order to prevent adhesions to the tibia and to get better lateral lift. The lateral slip is attached to the PB or PT tendons at maximum tension. The medial slip is sutured to the TAN tendon at neutral tension. The leg is placed in a POP cast for 3 weeks with the foot dorsiflexed to 65° to relieve tension on the joins. In the CT route the TP tendon is brought medially around to the front of the tibia subcutaneously. After being withdrawn into the lower medial leg the TP tendon is split into two slips and tunnelled to the dorsum of the foot. The slip to the peroneal tendons must cross the ankle joint at least 3 cm above the mid-ankle to ensure eversion.

After 3 weeks the cast is split and intensive reeducation is begun. This includes contracting only TP to dorsiflex the foot and later practicing co-ordination exercises (alternate dorsiflexion and relaxation but not plantar flexion) and relearning 'swing phase walking' with crutches. In the third week the patient is allowed partial weight bearing in parallel bars or with crutches and continues to practice swing phase walking in parallel bars. From the fourth week out of POP (at least 6 weeks post-op) plantar flexion is encouraged and the patient is given a sandbag (500–1000 gm) to use during exercising to encourage strengthening of the muscle. They also gradually increase weight bearing so that by the sixth week out of POP they can walk without crutches. In the sixth week out of POP they practice on stairs and usually at the end of that week are ready for discharge.

Results

The average age was 33·5 years (13–75 years). Fifty-two operations were on the left foot (47%) and 58 on the right foot (53%). The average duration of footdrop prior to operation was 4 years 5 months. Eighty feet (73%) had a complete footdrop while in 30

feet (27%) only the dorsiflexors were affected and the evertors were normal. The CT route was used in 43 feet (39%) mostly before 1992. The IO route was used in 67 feet (61%).

The medial slip of the TPT was attached to TAN in 104 feet (95%) and to EHL (an old preferred method) in 6 feet (5%). The lateral slip was attached to EDL in 56 feet (51%) and to the peronei in 54 feet (49%). It is my impression that the attachment to EDL leads to a higher incidence of claw toes in mobile toes and so is not now used.

The average duration of immobilization in POP was 28 days (21–42 days) and the average time to discharge from the date of operation was 10 weeks (6–30 weeks). The average final follow-up was 31 months (6–85 months). Of the 59 feet for whom pre-op and final follow-up data on further bone loss (ditigal or metatarsal absorption—a measure of recurrent ulceration) is available, 45 (76%) did not have any further bone loss and only 2 feet (4%) suffered more than 2 'points' bone loss after the operation. (Each toe and each metatarsal head counts as one 'point'.)

All of the CT TPTs and half of the IO TPTs were done prior to 1992. Since 1992 we have performed IO TPT almost exclusively (2 exceptions—patients with a calcified unyielding IO membrane). Thus there is a significant difference in the duration of follow-up (CT = 4·27 years, IO = 1·55 years) between CT and IO TPTs.

Long-term follow-up data regarding inversion was available in 69 patients. Of 26 patients who had CT TPTs 21 had recurrent inversion compared with only 1/43 of those who had an IO TPT. (Even this one patient had an unusual variation of the operation performed by another surgeon with the whole TP tendon attached medially and a fascia lata graft connecting the peroneus to the TP tendon at the anterior lower leg. In this case, apparently, the fascia was not attached with enough eversion and may have stretched.)

The relative risk for inversion at final follow-up for the CT route compared with the IO route is 8·97 with an odds ratio of 176·4 (χ-square 45·91, $p = 0{\cdot}0000000$). Having only an anterior muscle paralysis (normal evertors) was not protective against inversion at final follow-up in CT TPT. Of 16 patients with medial footdrop 3/6 who underwent CT TPT developed recurrent inversion *vs* 0/10 in the IO TPT group ($p = 0{\cdot}036$). For differences in angles between CT and IO routes see Table 1.

Only 6 patients in this study did not have a TAL. At final follow-up patients who had a TAL had a significantly greater likelihood of an ADF above 90°. Failure to do a TAL can lead to a poor result.

Table 1.

	Circumtibial	Interosseous	*p* value
No. of feet operated	34	67	–
Long term follow-up	26	43	–
Recurrent inversion	21	1	0·00001
ADF at discharge	81·9°	77·3°	0·00003
APF at discharge	102·6°	89·5°	0·0264
ADF final follow-up	90·3°	81·6°	0·00009
APF final follow-up	111·6°	98·8°	0·003
ROM final follow-up	21·3°	18·3°	0·374*
Final follow-up years	4·27	1·55	

*Not statistically significant.

Discussion

In this study TPT (either route) provides ADF above 90° in 80% of patients, with restoration of normal gait (ADF above 95°) in 94% of patients. A summary of some of the literature is given in Table 2. ADF above 90° is possible in between 65 and 95% of patients according to these studies. Richard[9] has pointed out that for the transfer to function well, it should partly function as a tenodesis. That the transfer also has an active component is obvious from the 22° ROM of patients in this study. However it is important that this ROM should be in the functional range (80°–100°) for normal gait. Depending on the terrain a patient with ADF (only up to 90°) may still have a normal gait if they live on the plains. Patients who live in the hills require a greater ROM (10°ADF and 10° APF) in order to clear the ground going uphill and easily walk downhill.

The CT route however is associated with an unacceptably high rate of recurrent inversion leading to recurrent lateral border foot ulceration. This observation was made

Table 2. Comparison of published results of TPT

	Route	Attachment	Result
Author (number of feet)			
Andersen[1] (108)	CT/IO	tarsal bone or TA/EHL	heel-toe gait in 65 excellent or good in 72
Andersen[2] (12)	CT	EHL/EDL	excellent/good in 11
Carayon[3] (23) (TPT+FDL)	IO	TP-TA FDL-EDL	excellent (>50 ADF) in 18
Fritschi[4]	CT/IO	tarsal bone	CT better ROM than IO
Gunn[5] (56)	CT/IO	tarsal bone	49 satisfactory criteria not stated
Hall[6] (65)	IO	EHL/cuneiform	3 good, 1 poor (4 total)
	CT	EHL/EDL (35)	10 good, 16 fair
			6/23 recurrent inversion
	CT/IO	TP-TA (26) FDL-EDL	7 good, 11 fair
Malaivya[7] (98)	CT	cuneiform (20)	15 good heel-toe gait
		EHL/EDL (78)	53 good heel-toe gait
Palani[8] (76)	CT/IO		62 ADF above 90°
Richard[9] (39)	IO	EHL/EDL, PL	37 ADF above 90°
Selvapandian[11] (39)	CT/IO	tarsal bone	CT better ROM than IO
Srinivasan[12] (39)	CT	EHL/EDL, PT	22 ADF above 90° 12 ADF up to 90°
Thangaraj[13] (68)	CT	TA/EDL	60 patients >25° ROM 5 patients recurrent inversion
Warren[14] (13)	IO	TA/PB 5th MT	9 had good gait
Weber[15] (25)	CT/IO	TA/PB	21 ADF above 90°
Soares (110)	CT (43)	TA/EDL	38 ADF above 90°
	IO (67)	TA/PB	65 ADF above 90°

by Hall[6] and Thangaraj[13] in smaller groups of patients. CT TPT should be reserved for those patients with a calcified and unyielding IO membrane (usually elderly with recurrent inflammation/infection in the foot). If CT TPT is performed, the tendon bifurcation must be at least 3 cm above the ankle so that the line of pull is as close to the vertical as possible. Wherever possible IO TPT should be used.

There is no evidence (from this study) of the crippling adhesions associated with the IO route mentioned by Anderson[1] as there is no signficant difference in active ROM at final follow-up (CT 14/16 more than 10° *vs* IO 28/30 more than 10°, $p = 0{\cdot}244$). It is possible that if only a small window is made in the IO membrane that the transfer would get adherent there. This may explain previous observations[4,11] that the CT route provides a better ROM than the IO route. In this series the IO membrane was widely opened. There have been no vascular complications from this. The ROM of both groups in this study was similar (CT 21·3°, IO 18·3°, $p = 0{\cdot}374$).

The IO route is associated with better active ADF though less active plantar flexion both at discharge and at final follow-up when compared with the CT route. This may reflect the attachment of the tendon at a higher tension. It also reflects the greater efficiency of the transferred force from the tendon acting at a better angle of pull in the IO route.

It is noteworthy that the ADF will drop by 10° between the angle of suture and discharge from hospital. The ADF will drop a further 5°–10° between discharge and late follow-up (average fall—CT 8·4°, IO 4·3°). It is essential to suture the tendons with the foot dorsiflexed to at least 70° to allow for later stretching of the muscle-tendon unit.

Conclusion

TPT is an excellent procedure for the correction of footdrop due to leprosy neuritis, resulting in a normal gait in 94% of patients. To avoid recurrent inversion the IO route is preferred. An open TAL should always be performed. The TP tendon should be attached to TAN and to PB or PT tendons wherever possible. It may be attached to toe extensors only if there are no toes or the toes are not mobile otherwise clawtoes may result. The tendons should be sutured with the foot dorsiflexed to at least 70° as the foot will drop at least 10° between removal of POP and follow-up at one year. Three weeks immobilization in a POP cast at 65° to relieve tension on the anastomosis is sufficient, and is followed by 6 weeks graduated postoperative re-education. Full weight bearing and active plantar flexion are permitted at 6 weeks postoperation.

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Lepr Rev (1995) **66,** 235–238.

Hand wounds in leprosy patients

D. SOARES & N. DESAR
Anandaban Leprosy Hospital, P.O. Box 151, Kathmandu, Nepal

Accepted for publication 27 March 1995

Summary This study assessed the causes, duration and site of hand wounds seen among patients in order to try and improve the delivery of self-care teaching to patients with anaesthetic hands. Seventy-seven patients with 102 affected hand surfaces were assessed. The commonest cause was a burn from a tea glass. The average duration of the wound was 2 weeks. Most patients had a single current wound and 62% of wounds were on the palmar surface.

Introduction

The aim of this study was to identify the common causes of hand wounds among leprosy patients in Nepal with a view to focusing our health education in order to reduce the future damage to insensitive hands.[1]

Methods

All patients with hand wounds over a six-week period were notified to ND by the other physiotherapy technicians and our other clinical staff. To simplify assessment we assessed each hand as two surfaces (dorsal and palmar). Thus each patient could have a maximum of 4 surfaces affected. Each surface was tested at 14 standard sites (Figure 1). Patients who presented as outpatients as well as inpatients were assessed. All assessments were done by one physiotherapy technician (ND). They had a sensory map (using a 2-g nylon filament) of the affected surface recorded as well as the wounds and any bone loss charted. The patient's name, hospital number, cause of wound and surface was also recorded on our standard sensory testing forms.

Results

We assessed 77 (58 male, 19 female) consecutive patients who had 102 affected hand surfaces. Of these, 60 patients had 1 surface affected, 11 patients had 2 surfaces affected, 4 patients had 3 surfaces affected and 2 patients had all 4 surfaces affected.

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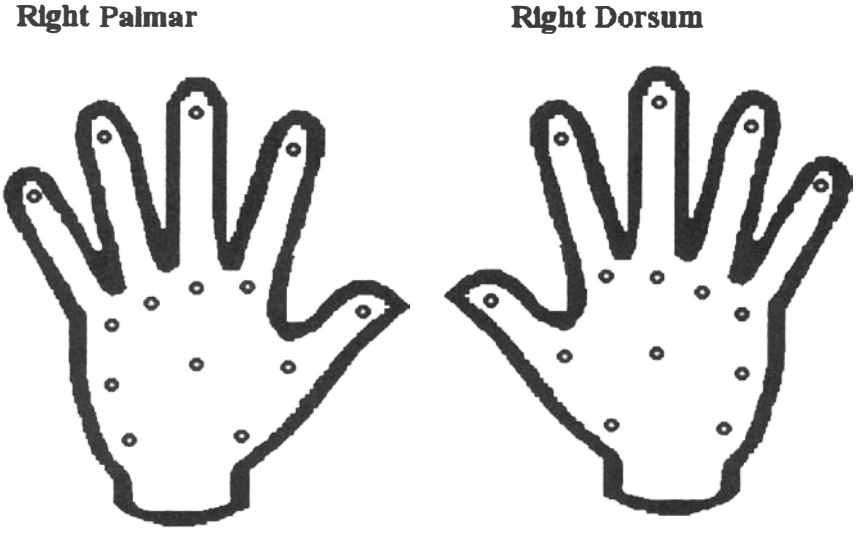

Figure 1. Hand sensory map showing standard testing sites.

All the rest of the data relates to surfaces affected (as *c.f.* patients).

The left hand was affected in 54% and the right hand in 46%. The dorsal surface was affected in 32% and the palmar surface in 68%.

Seventy-one percent of affected surfaces were fully anaesthetic, whereas only 6% of affected surfaces had anaesthesia at less than 3 sites (out of 14). There were no wounds at sites with normal sensation, i.e. the risk of getting a wound is directly related to sensory loss as judged by a 2-g nylon filament.

Most patients (79%) had only 1 wound. However 13% had 3 or more wounds, see Table 1.

In 70% of surfaces patients had not lost any bone from the hand. Each testing site where the digit was shortened or bone lost was counted (Figure 2). Eighteen percent had lost bone at 1–3 sites (out of 14), 13% had lost bone at 4 or more sites.

In 50% of patients the duration of the wound was less than 2 weeks, 30% of patients presented 2–4 weeks after onset of the wound, and 20% of patients had wounds for more than 4 weeks.

The commonest cause of wounds was a burn (61%) either from a hot object (43% of surfaces), usually a tea glass, or directly from a fire (18% of surfaces). The other causes are listed in Table 2. In 10% of patients the cause was not found.

Seventy-two percent of patients had open wounds. The remainder (28%) when seen had closed blisters.

Table 1

Number of wounds:
1 wound – 81 surfaces (79%)
2 wounds – 8 surfaces (8%)
3 wounds – 11 surfaces (11%)
4 wounds – 2 surfaces (2%)

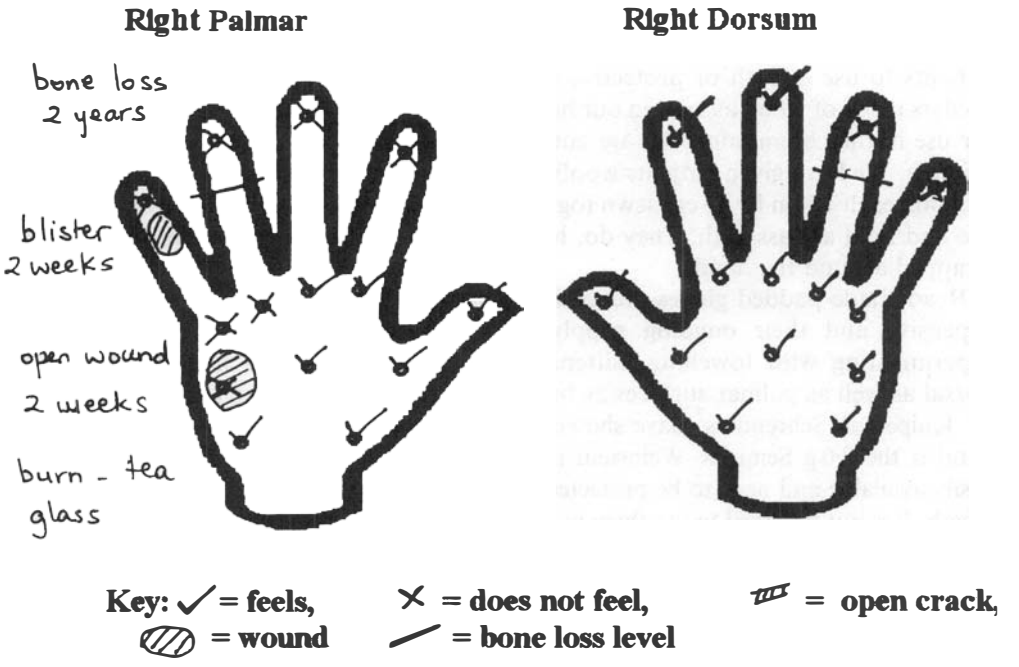

Figure 2. Sample patient map showing anaesthesia, wounds and bone loss.

There was no significant difference between males and females in any of the following: number of wounds, touch sensation to 2-g nylon filament, bone loss, cause of wound, side affected, surface, number of sites or duration of wound.

There was no significant difference in number of wounds, side affected, surface, number of sites for wounds caused by different categories, e.g., burn versus rough object.

Discussion

Ascertaining the cause of wounds in patients with insensitive hands is always difficult. It takes patience on the part of staff not to accept the standard 'It just came by itself' and to search with the patient for the true cause. Although time consuming this is the essential first step on the road to prevention of further injuries.

Table 2

Cause of wound:
18% direct burn from fire
43% burn from hot object (usually tea glass)
11% sharp object
12% rough object
7% friction
10% other/unknown

The commonest cause in our study of hand wounds is a burn from a hot object (usually a tea glass). There is great scope for prevention of these injuries by teaching patients to use a cloth or protective glove to hold hot objects.[1] Traditional tea glass holders made of wood as used in our hospital are fine for inpatients but not as acceptable for use in the community. We are currently trying out what varieties might be locally suitable. We have given patients woollen square gloves (made from two knitted squares of wool, each 15 cm by 15 cm sewn together on 3 sides) but these have proved difficult to use and hold a glass with. They do, however, protect the fingertips more than a cloth wrapped around the hand.

Readymade padded gloves are available in the tourist shops in Kathmandu but are expensive and their ongoing supply to our patients is not sustainable. We are experimenting with towelling mittens. When cooking, patients need to protect the dorsal as well as palmar surfaces as both are almost equally vulnerable if insensitive.

Kuipers & Schreuders[2] have shown that the threshold for protective sensation in the hand is the 2·0 g Semmes–Weinstein monofilament (SWM). However filaments are not easily available and need to be protected from being kinked as well as being of a standard length. It is not practical to use them in integrated field programmes where care is provided by basic health service staff. We are testing different simple methods of testing (such as using the weight of a ballpen inclined at an angle) to see if they are as reproducible as the SWM.

We have also re-evaluated our teaching methods and hope to use more role-playing and actual demonstrations by patients rather than the traditional 'health talk' as a method of improving patient understanding and practice of hand self-care.

Most patients (70%) in our study have not had any bone loss due to complications of hand wounds. Further health education needs to be concentrated on these patients to ensure that they continue to preserve their hands. They need to be followed up to see which if any develop bone loss over a longer period of time. The 13% of patients who had lost bone at 4 or more sites are less likely to be able to stay wound free in the future but still deserve the time and effort spent in teaching them self-care.

Conclusion

This study of causes of hand wounds can help staff to gain an understanding of specific dangers to insensitive hands and help to focus patient training towards prevention of further injury.

Acknowledgments

Our thanks to Jean Watson of The Leprosy Mission International for her advice, encouragement and enthusiasm.

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Lepr Rev (1995) **66,** 239–249.

Problems, acceptance and social inequality: a study of the deformed leprosy patients and their families

S. N. M. KOPPARTY
Centre for Social Science Research on Leprosy, Gandhi Memorial Leprosy Foundation, Hindi Nagar, Wardha-442 103, India

Accepted for publication 25 April 1995

Summary Though the impact of social inequality on health conditions is widely known, its impact on the chronic and stigmatized disease, leprosy, has received little attention. Deformity sometimes leads to disabilities and to handicaps causing problems to the patient and his family. In this paper an attempt has been made to understand the impact of social inequality, prevalent in the form of the caste system in India on the deformed leprosy patients and on their families. This impact was examined in terms of the problems faced by the patients. A sample of 150 deformed patients and their families, drawn from two districts in Tamil Nadu, was selected for the study.

About 57% of the deformed patients experienced their deformity as a handicap which caused social and economic problems while the rest did not. Of the three caste groups, the Lower Caste group experienced more severe economic problems while the Upper Caste group faced more social problems. The extent of acceptance of deformed patients in their family varied significantly among those facing and not facing problems due to their deformity. The deformed patients without any handicap were accepted in a large majority of their families (82%) regardless of their caste status. In contrast the deformed but handicapped patients were accepted differentially among the three caste groups with the Upper group accepting them in most of their families (80%) while in the Lower group much less number of families (54%) did. All the families of the deformed but not handicapped patients desired to keep their patients till their death irrespective of their caste status. On the contrary, while all the families in the Upper Caste group expressed their willingness to keep their handicapped patients in the family till their death, 10% in the Middle and 22% in the Lower Caste groups did not want to do so. This suggests the gradual marginalization, rejection and dehabilitation of the affected. Thus, one's caste status can be a broad indicator of the nature and the extent of handicaps and acceptance in the family. This factor needs to be appropriately taken care of for rehabilitation and disability management in leprosy control programmes.

Introduction

Social inequality in India is widely prevalent through a caste system. A caste system is

0305-7518/95/066239+11 $1.00

one whereby a society is divided into a number of self-contained units (castes), the mutual relations between which are ritually determined in a graded scale.[1] A caste is a social group that follows a traditional occupation, observes eating of prescribed foods, restricts a person to marry within the same caste, limits social interaction and prohibits higher caste individuals from being 'polluted' by contact with Lower Caste individuals.[2–4] Caste status reflects the customs, values, occupations, accessibility or denial to various resources including health, life-style and culture of a group which is sometimes in marked contrast to others.[5] It is a broad indicator of the social, economic and ritual status that a group enjoys in the society. There are about 3000 castes in India. The impact of socioeconomic inequalities on the health conditions of population has been well documented.[6–10] However, very little is known about the influence of caste on morbidity[11–14] and even less, in a stigmatized disease like leprosy.[15–16]

About two-thirds of leprosy patients registered in the world are in India.[17] Between 5 and 15% of them are deformed.[18] Together with the already deformed, but not with active disease the number of persons deformed due to leprosy in the country is much greater. Deformity is the most dreaded state in leprosy. It often leads to disabilities. Disability refers to any restriction or lack of ability to perform an activity that results from deformity. Deformity or disability may lead to a 'handicap' which refers to a disadvantage for a given individual that limits or prevents the fulfilment of the normal role of the individual.[19–20] While deformity may cause a handicap to some, it may not do so to others. It is closely related to one's social characteristics such as social status, occupation, age, sex etc. The meaning of handicap, therefore, changes as per a given social situation.[21–22]

Deformity or handicap has considerable impact on the life of the affected in terms of general well-being, adjustment and happiness. Leprosy is known to cause economic, social and psychological problems and more so, if it is associated by deformities and handicaps.[23–29] The problems caused by a handicap due to leprosy will affect acceptance by the individual's own family, subsequently leading to marginalization, rejection and dehabilitation, depending upon the nature of handicap. The manifestation of deformity into a handicap and its impact on the affected and their family depends broadly upon the values, occupation, economic resources and life-style of the caste group to which they belong. This paper seeks to understand the impact of the caste system on the nature and extent of problems faced by deformed leprosy patients.

Materials and methods

Two districts—one with a high prevalence (South Arcot P.R. 16·4/1000), and the other with a low prevalence (Kanyakumari P.R. 4·8/1000)—of Tamil Nadu were selected for the study conducted in 1989–90. Both the districts were under monotherapy at the time of investigation. In each district two leprosy control units (LCU)—one in a rural area and the other in an urban area—were selected using the same prevalence criterion. A sample of 500 patients and their families drawing 125 from each control unit were selected through systematic random sampling methods.

Of these, 150 patients had deformities. The data on the deformed patients and their families are analysed in depth in this paper. Data were collected through interview schedules and informal interviews. The caste status of all the families was categorized

into Upper, Middle and Lower Groups based on the ritual and social status, as determined by a group of well-informed individuals in the community. Thus, (i) the Upper Group consisted of ritually pure, economically, educationally and socially advanced castes, (ii) the Lower Group comprised of untouchable castes which are ritually impure, poor, landless, illiterate, residentially segregated, and engaged in low paid occupations, and (iii) the Middle Group consisted of the rest of the castes which are treated as ritually pure, mostly small peasants, artisans, and the less literate.

The status of the patients was categorized into 'non-deformed' comprising of mere patches or nodules and 'deformed' consisting of change in form, loss of functioning or loss of any part of the body. The deformity was further categorized into a handicap or a non-handicap depending on the patient's self-reporting about the nature of problems it causes him in his daily living.

Results

Of the total sample of 500 patients, the Upper, Middle and Lower Caste groups formed 11·2%, 61·8% and 27%, respectively, which corresponds closely to their respective proportion in the general population. However, the proportion of deformed patients differ significantly among the three caste groups. The Upper Caste group had a comparatively smaller proportion of deformed patients (19·6%) than the Middle Caste (33%) and Lower Caste (27·4%) groups. Furthermore, the deformed patients who became handicapped also varied in the three caste groups. While there were only 9% of the patients handicapped in the Upper Caste group, it was 17·4 and 20% in the Middle and Lower Caste groups, respectively. Thus, the proportion of handicapped progressively increased from the Upper to Lower Caste groups (Table 1).

Of the 150 deformed patients, 86 patients (57·3%) found their deformity to be a handicap in employment, or when participating in community activities etc. When the employment of the patients was affected, their family faced economic problems often depriving them of their daily necessities. Similarly, they were not well received by their friends, relatives, neighbours and were not invited to community functions. The marital prospects of patients themselves or their family members were also affected. In contrast, the remaining 64 patients (42·7%) did not experience their deformity as a handicap and as a result did not face any problems.

The social and medical characteristics of the handicapped (HP) and non-handicapped

Table 1. Distribution of non-deformed and deformed leprosy patients in caste groups

Status	Lower Castes	Middle Castes	Upper Castes	Total
Non-deformed patients	98 (72·6)*	207 (67·0)	45 (80·3)	350 (70·0)
Deformed patients				
Non-handicapped	27 (20·0)	54 (17·4)	5 (08·9)	86 (17·2)
Handicapped	10 (07·4)	48 (15·5)	6 (10·7)	64 (12·8)
Total	135 (27)	309 (61·8)	56 (11·2)	500 (100)

* Percentage in parentheses.

Table 2. Medical and social characteristics of handicapped and non-handicapped leprosy patients

Characteristic	Deformed non-handicapped patients ($N = 64$)	Deformed handicapped patients ($N = 86$)
Medical		
Type of leprosy		
PB	20 (52·6) *	18 (47·4)
MB	44 (39·3)	68 (60·7)
Duration of disease		
Up to 5 years	21 (67·7)	10 (32·3)
5–10 years	14 (35·9)	25 (64·1)
More than 10 years	29 (36·2)	51 (63·8)
Nature of deformity		
Mild	19 (55·9)	15 (44·1)
Severe	45 (38·8)	71 (61·2)
Social		
Castle status		
Lower Castes	10 (27·0)	27 (73·0)
Middle Castes	48 (47·1)	54 (52·9)
Upper Castes	6 (54·5)	5 (45·5)
Sex		
Male	39 (36·1)	69 (63·9)
Female	25 (59·5)	17 (40·5)
Age		
<35 years	12 (42·9)	16 (57·1)
35–50 years	21 (35·0)	39 (65·0)
>50 years	31 (50·0)	31 (50·0)
Marital status		
Unmarried	8 (34·8)	15 (65·2)
Married	48 (45·7)	57 (54·3)
Widowed	8 (44·4)	10 (55·6)
Separated	–	4 (100)
Change in occupation		
No	43 (50·6)	42 (49·4)
Yes	10 (21·3)	37 (78·7)
NA	11 (61·1)	7 (38·9)
Reason for change in occupation		
Due to other reason	5 (35·7)	9 (64·3)
Due to deformity	7 (17·9)	32 (82·1)
Due to stigma	–	2 (100)
NA	52 (54·7)	43 (45·3)
Change in income due to leprosy		
No change	36 (48·0)	39 (52·0)
Yes	10 (21·7)	36 (78·3)
NA	18 (62·1)	11 (37·9)
Annual expenses for treatment		
Nil	55 (47·0)	62 (53·0)
<Rs 1000	5 (26·3)	14 (73·7)
>Rs 1000	4 (28·6)	10 (71·4)

* Percentage in parentheses.

(NHP) patients are presented in Table 2. A larger number of handicapped than non-handicapped patients were males (HP 63·9%, NHP 36·1%), unmarried (HP 65·2%, NHP 34·8%), changed occupation (HP 78·7%, NHP 21·3%) and of a productive age group (35–50 years, HP 65%, NHP 35%). Further, of those whose income declined due to leprosy and who spent about thousand rupees or more annually for treatment, three-quarters of them were handicapped. The medical characteristics show that a larger number of handicapped patients than non-handicapped patients had multibacillary leprosy (HP 60·7%, NHP 39·3%) and had suffered for more than 10 years (HP 63·8%, NHP 36·3%) and were severely deformed (HP 61·2%, NHP 38·8%).

The problems faced by the families of the handicapped deformed patients were economic and social in nature. The economic problems faced include: 1, loss of main source of income because of loss of occupation; 2, loss of additional source of income; 3, loss of savings; and 4, incurring debt to meet the family expenditure. The social problems were: 1, denial of participation in community activities; 2, dislike by relatives, friends, villagers etc; and 3, diminished marital prospects of the patients or their family members. A considerable proportion of families (31·3%) faced some economic problems only while a small proportion of families (6·7%) faced some social problems only. On the otherhand, there were families which faced some economic and some social problems together (13·3%). Still further, some families faced all aspects of both economic and social problems listed above (6·0%) (Table 3).

Of the three caste groups, a large majority of the deformed patients in the Lower Caste group faced economic and social problems (73%) compared to a comparatively lesser number in the Middle (53%) and the Upper Caste (45·5%) groups. The nature and magnitude of problems faced differed significantly in the three caste groups. While the handicapped patients in the Lower Caste group faced exclusively economic problems in a greater proportion (43·2%), fewer in the Middle Caste (29·4%) and the least in the Upper Caste groups (9·1%) did so. In contrast, the exclusively social problems faced by the patients and their families, progressively increased from Lower (2·7%) to Middle (6·9%) and to Upper Caste (18·2%) groups. Similar observations can be made in the case of the handicapped patients facing partly economic and partly social problems. It is

Table 3. Distribution of families with handicapped patients facing problems and families without handicapped patients in Caste groups

Type of family	Lower Castes	Middle Castes	Upper Castes	Total
Families without handicapped patients (no problems)	10 (27·0) *	48 (47·1)	6 (54·5)	64 (42·7)
Families with handicapped patients (facing problems)				
Economic	16 (43·2)	30 (29·4)	1 (09·1)	47 (31·3)
Social	1 (02·7)	7 (0·69)	2 (18·2)	10 (06·7)
Partly social & partly economic	4 (10·8)	14 (13·7)	2 (18·2)	20 (13·3)
All together	6 (16·2)	3 (02·9)	–	9 (06·0)
Total	37 (100)	102 (100)	11 (100)	150 (100)

* Percentage in parentheses.
χ-square = 18·61 $P = 0·01$.

significant to note that a sizeable proportion of handicapped patients in the Lower Caste group (16·2%) faced all dimensions of both economic and social problems while a negligible proportion of patients from the Middle Caste (2·9%) group faced such problems. On the other hand, there was not even a single family in the Upper Caste group which faced all problems together.

While the families of the Lower Caste group were the worst affected by economic problems, the Upper Caste group families experienced comparatively greater social problems. This is shown by the annual income of the handicapped patients and the extent and reasons for change in their occupation (Tables 4 and 5). Most of the handicapped patients in the Lower Caste group (85·2%) were concentrated in the lowest income bracket of less than Rs. 2500 per annum while only 50% in the Middle and 20% in the Upper Caste Groups were in the same bracket. Similarly, two-thirds of the handicapped patients in the Lower Caste group (66·7%) changed their occupation due to deformity while only 24% in the Middle and 20% in the Upper Caste groups did so. Generally, change in occupation leads to accepting less demanding and less remunerative work resulting in a fall in income which leads to economic problems.

In contrast, the Upper Caste families faced more social problems because of their higher social status in the society. This suggests that there is greater stigma in the Upper Caste group than in the Lower Caste group. Thus, the nature and extent of problems faced by the Upper and Lower Caste groups varied considerably.

Selected aspects of the acceptance of the handicapped and non-handicapped patients in their family was examined, e.g. the sharing of clothes, use of dining place, participation in decision making, participation in functions in the family, dining with other

Table 4. Distribution of handicapped (HP) and non-handicapped patients (NHP) in income (annual) categories among Caste groups

Annual income (Rupees)	Patients Non-Handi (NHP) Handi (HP)	Lower Castes	Middle Castes	Upper Castes	Total
< 2500	NHP	5 (50·0)*	27 (56·2)	2 (33·3)	34 (53·1)
	HP	23 (85·2)	27 (50·0)	1 (20·0)	51 (59·3)
2501–5000	NHP	1 (10·0)	3 (06·2)	1 (16·7)	5 (07·8)
	HP	2 (07·4)	9 (16·7)	–	11 (12·8)
5001–10,000	NHP	3 (30·0)	14 (29·2)	2 (33·3)	19 (29·7)
	HP	2 (07·4)	13 (24·1)	2 (40·0)	17 (19·8)
10,001–25,000	NHP	1 (10·0)	2 (04·2)	1 (16·7)	4 (06·2)
	HP	–	5 (09·2)	1 (20·0)	6 (07·0)
>25,000	NHP	–	2 (04·2)	–	2 (03·2)
	HP	–	–	1 (20·0)	1 (01·1)
Total	NHP	10 (100·0)	48 (100·0)	6 (100·0)	64 (100·0)
	HP	27 (100·0)	54 (100·0)	5 (100·0)	86 (100·0)
Grand Total		37	102	11	150

*Percentage in parentheses.
χ-square NHP 3·66060 P ·9614.
HP 30·35720 P ·0002.

members in the family etc. In general, non-handicapped patients were accepted in a larger number of families (82·3%) than handicapped patients (64%). This shows that as long as the deformity does not turn out to become a handicap, the deformed patients were accepted more widely than the handicapped. Table 6 details the acceptance of handicapped and non-handicapped patients in different social aspects. In some aspects both the handicapped and non-handicapped patients were accepted to the same extent while there was a wide difference in others. For example, with regard to taking meals with other family members only 50% of the patients were allowed to eat with other family members, regardless of their handicap. Similarly, for accompanying patients to the clinic only 30% of the families extended their support to the patients. In other aspects, the differences varied considerably. While only 40% of the handicapped patients were allowed by their families to do their household duties as expected of their role, such as participation in functions, visiting relatives etc, 81% were allowed in the case of non-handicapped patients. Similar findings, though to a much lesser extent, can be seen with regard to the sharing of bedding of the patient by other family members (NHP 92·2%, HP 59·3%), sharing of clothes (NHP 89·1%, HP 60·5%), participation in family celebrations (NHP 93·8%, HP 65·1%), use of dining place (HP 95·3%, NHP 75·6%), mixing freely with other family members (NHP 98·4%, HP 79·1%) etc. While all families wanted to keep their non-handicapped patients till their death, only 86% of families of handicapped patients wanted to do so. This means that 14% of handicapped patients are in the process of marginalization which may lead to rejection and dehabilitation.

Of the three caste groups, a slightly greater number of families in the Lower Caste group (87%) accepted their non-handicapped patients than the Middle (81·2%) and Upper (83·3%) Caste groups. In contrast, a larger number of families in the Upper Caste group (80%) accepted their handicapped patients than the Middle (65·4%) and Lower Caste (54·4%) groups. This shows that while the non-handicapped patients were widely

Table 5. Reason for change in occupation by the handicapped (HP) and non-handicapped (NHP) leprosy patients in caste groups

Reason	Patients Non-Handi (NHP) Handi (HP)	Lower Castes	Middle Castes	Upper Castes	Total
Deformity	NHP	2 (20·0) *	5 (10·4)	–	7 (10·9)
	HP	18 (66·7)	13 (24·1)	1 (20·0)	32 (37·2)
Stigma	NHP	–	–	–	–
	HP	–	2 (03·7)	–	2 (02·3)
Other reasons	NHP	–	3 (06·3)	2 (33·3)	5 (07·8)
	HP	1 (03·7)	8 (14·8)	–	9 (10·5)
NA	NHP	8 (80·0)	40 (83·3)	4 (66·7)	52 (81·3)
	HP	8 (29·6)	31 (57·4)	4 (80·0)	43 (50·0)
Total	NHP	10 (100·0)	48 (100·0)	6 (100·0)	64 (100·0)
	HP	27 (100·0)	54 (100·0)	5 (100·0)	86 (100·0)
Grand total		37	102	11	150

* Percentage in parentheses.
χ-square NHP 7·53700 P ·1101.
HP 16·79591 P ·0101.

accepted irrespective of their caste status, the handicapped patients were accepted less and less from Upper to Lower Caste groups. This indicates that the magnitude of the impact of handicap differs and increases progressively from Upper to Lower Caste group. The differential in acceptance of handicapped patients among the three caste groups is more striking in some individual aspects such as sharing of clothes, use of common dining place etc (Table 6).

While all the families of non-handicapped patients regardless of their caste status wanted to keep their patients with them till their death, only 77% of the families of the handicapped in the Lower and 89% in the Middle Caste groups desired to do so. In

Table 6. Number of families accepting their handicapped (FHP) or non-handicapped (FNHP) leprosy patients in selected aspects

Aspect	Families with Non-Handi Pat (FNHP) Handi Pat (FHP)	Lower Castes NHP ($N = 10$) HP ($N = 27$)	Middle Castes NHP ($N = 48$) HP ($N = 54$)	Upper Castes NHP ($N = 6$) HP ($N = 5$)	Total NHP ($N = 64$) HP ($N = 86$)
Sharing of clothes with the patient	FNHP	10 (100)*	42 (87·5)	5 (83·3)	57 (89·1)
	FHP	12 (44·4)	36 (66·7)	4 (80·0)	52 (60·5)
No separate bedding provided to the patient	FNHP	10 (100)	43 (89·6)	5 (83·3)	58 (90·6)
	FHP	12 (44·4)	35 (64·8)	4 (80·0)	51 (59·3)
Patient allowed to use common dining place	FNHP	10 (100)	45 (93·8)	6 (100)	61 (95·3)
	FHP	14 (51·9)	46 (85·2)	5 (100)	65 (75·6)
Allowed to take meals with other family members always	FNHP	6 (60·0)	24 (50·0)	3 (50·0)	33 (51·6)
	FHP	13 (48·1)	26 (48·1)	4 (80·0)	43 (50·0)
Never discouraged patient mixing freely with other family members	FNHP	10 (100)	47 (97·9)	6 (100)	63 (98·4)
	FHP	21 (77·8)	43 (79·6)	4 (80·0)	68 (79·1)
Allowed in decision making in the family as before occurance of the disease	FNHP	10 (100)	44 (91·7)	6 (100)	60 (93·8)
	FHP	19 (70·4)	46 (85·2)	4 (80·0)	69 (80·2)
Allowed to participate in family celebrations as before occurrence of the disease	FNHP	10 (100)	44 (91·7)	6 (100)	60 (93·8)
	FHP	16 (59·3)	36 (66·7)	4 (80·0)	56 (65·1)
Allowed to perform all household duties as before occurrence of the disease	FNHP	8 (80·0)	38 (79·2)	6 (100)	52 (81·3)
	FHP	12 (44·4)	19 (35·2)	3 (60·0)	34 (39·5)
Family members help in accompanying patient to clinic invariably	FNHP	3 (30·0)	15 (31·3)	1 (16·7)	19 (29·7)
	FHP	5 (18·5)	18 (33·3)	3 (60·0)	26 (30·2)
Wishing to keep the patient in the family until death	FNHP	10 (100)	48 (100)	6 (100)	64 (100)
	FHP	21 (77·8)	48 (88·9)	5 (100)	74 (86·0)
Mean	FNHP	8·7 (87·0)	39 (81·2)	5 (83·3)	52·7 (82·3)
	FHP	14·7 (54·4)	35·3 (65·4)	4 (80·0)	55·0 (64·0)

* Percentage in parentheses.

Table 7. Number of families accepting or not accepting the handicapped and non-handicapped patients in selected aspects

Status	Handicapped patients	Non-handicapped patients	Total
Accepted	54 (62·8)*	53 (82·8)	107 (71·3)
Not accepted	32 (37·2)	11 (17·2)	43 (28·7)
Total	86 (100)	64 (100)	150 (100)

* Percentage in parentheses.
χ-square = 7·1932 $P = \cdot 01$.

contrast, all the families in the Upper Caste group desired to keep their handicapped patients till their death. This shows that about a quarter of the handicapped patients in the Lower Caste group were in the process of marginalization and dehabilitation while it is much less (10%) in the Middle Caste group. The economic hardship coupled with low social status facilitates marginalization, rejection and dehabilitation of the patients in the Lower Caste group. The extent of acceptance in the family and the status of deformity (handicap and non-handicap) of the patients is significantly associated ($P = 0{\cdot}01$) (Table 7). The number of families accepting the handicapped patients decreased from the Upper (80%) to Lower (55%) Caste groups (Table 8).

Discussion

Deformity due to leprosy affected the three Caste groups in different ways. While deformity was experienced as a handicap by three-quarters of the patients in the Lower Caste group it was much less so in the Middle (53%) and still less in the Upper Caste (45%) groups. The nature and severity of the impact of handicap also differed widely. While the handicap caused economic problems in 96% of the families in the Lower Caste group it did so less in the Middle (87%) and much less in the Upper (60%) Caste groups. In contrast, while the handicap caused social problems in about 40–44% of the families of Lower and Middle Caste groups, it did so almost twice as much (80%) in the Upper Caste group. While the handicapped patients in the Lower Caste group mostly faced economic problems, those in the Upper Caste group mostly faced social problems. The Middle Caste group was closer to the Lower Caste group in facing economic and social problems though in slightly lesser magnitude.

Table 8. Number of families accepting or not accepting their handicapped patients in Caste groups

Status	Lower Castes	Middle Castes	Upper Castes	Total
Accepted	15 (55·6)*	35 (64·8)	4 (80·0)	54 (62·8)
Not accepted	12 (44·4)	19 (35·2)	1 (20·0)	32 (37·2)
Total	27 (100)	54 (100)	5 (100)	86 (100)

* Percentage in parentheses.

In terms of acceptance, the deformed patients without any handicap were accepted in most of the families (82%). Their acceptance dwindled down (64%) once the deformity became a handicap. The handicapped were accepted differently in the three caste groups with the Upper Caste group accepting them in a larger number of their families (80%) than the Middle (65·4%) and Lower (54%) Caste groups. The differing acceptance may be attributed to the life-chances of the three caste groups. The Lower Caste group is mostly landless, poor and dependent on physical labour largely in agriculture, industry etc. Deformities can thus become handicaps more easily, manifested by occupational change incurring debt, depletion of savings etc. On the other hand, this is less true in the Upper Caste group as they have more reserve resources and opportunities. Also the Upper Caste group seems to attach greater value to prestige and status and as a result, handicapped patients listed their problems more as social than economic. On the other hand, the Lower Caste group is hard pressed to meet their immediate economic problems and may worry less about things such as physical appearance. In this group, economic problems lower the acceptance of the handicapped patients in the family more than social problems.

The above discussion suggests the importance of rehabilitation of the handicapped patients especially those belonging to Lower Caste group as they are the most affected by their disabilities. Studies have demonstrated the restoration of dignity, status and acceptance of the affected patients once they are economically rehabilitated.[30] Similarly surgical correction of deformities of leprosy is most rewarding in improving body image and erosion of stigma, functional capabilities and reduction of psychiatric morbidity.[31–32] Scientific studies have demonstrated that physical attractiveness will bring more success,[33] respect,[34] friends, happy marital life[35] and better social adjustment.[36] In view of these studies, it is necessary to correct deformities and provide rehabilitation to all the deformed patients. Counselling of patients and their family will help them in understanding the disease and the associated problems leading to better social adjustment. Effective health education to all groups would help in changing attitudes and developing greater understanding of the disease and acceptance of the patients. An understanding of the impact of social inequalities on the life of the affected will help in planning necessary interventions in the antileprosy programme.

Acknowledgments

The financial support provided by the Damien Foundation, Madras for this study is gratefully acknowledged. The author is thankful to Dr A. M. Kurup, Former Chief Research Scientist, Centre for Social Science Research on Leprosy, GMLF, Wardha for his encouragement and to Dr K. V. Desikan, Lepra Histopathology Centre, Sevagram for his valuable suggestions and help in preparing the final draft. Thanks are also given to the referees for their constructive comments. The secretarial assistance of Ms Kalpana Giawande is highly appreciated.

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Lepr Rev (1995) **66,** 250–256

Post-kala-azar dermal leishmaniasis mimicking leprosy: experience with 4 patients, with some unusual features in 1

SANDIPAN DHAR, INDERJEET KAUR, GOUTAM DAWN, SHOBHA SEHGAL* & BHUSHAN KUMAR†

*Departments of Dermatology, Venereology and Leprology, and *Immunopathology, PGIMER, Chandigarh-160012, India*

Accepted for publication 30 January 1995

Summary We report on 4 cases of post-kala-azar dermal leishmaniasis (PKDL). History of kala-azar was available in all 4 patients. Slit-skin smears (SSS) for leishmania donovani (LD) bodies were negative in all 4. In 3 patients hypopigmented lesions were present over the face. Papules and nodules over his lips, tongue, scrotum and dactylitis were some unusual features observed in 1 patient. Histopathological examination showed LD bodies in 2 patients; histopathology was nonspecific in the other 2. All the patients were treated with sodium stibogluconate, 20 mg/kg/day. Infiltrated papules and nodules had subsided by 3 months, while hypopigmented macules took longer to improve. In 3 patients there had previously been a misdiagnosis as leprosy sufferers and they had been treated with antileprosy drugs. Clinical and histopathological differences between PKDL and leprosy are discussed.

Introduction

Post-kala-azar dermal leishmaniasis (PKDL) is an unusual complication of visceral leishmaniasis (kala-azar) which is characterized by the development of hypopigmented macules, infiltrated papules, plaques and nodules over the skin. These usually occur after a variable period of treatment of kala-azar, although, occasionally, a history of kala-azar may be absent.[1,2] The condition is widely prevalent in Eastern India[3,4] and less frequently in the Sudan[2,5,6] and Kenya.[7] While in Indian cases lesions of PKDL develop 1–5 years after the apparent cure of visceral leishmaniasis,[3] those in Africa may develop during or shortly after treatment of kala-azar.[5,7]

Various similarities between PKDL and leprosy make differentiation difficult. Infiltrated papules, plaques and nodules over the face, earlobes and trunk are seen in both lepromatous leprosy (LL) and PKDL, whereas plaques and hypopigmented

† Correspondence: Department of Dermatology, Venereology and Leprology, Postgraduate Institute of Medical Education and Research, Chandigarh-160012, India.

0305-7518/95/066250+07 $1.00

macules seen in PKDL often create confusion with various types of borderline leprosy. Histologically the epithelioid cell granuloma may simulate tuberculoid leprosy, particularly when the parasites are scanty and are not identified in the infiltrate.[8] The occurrence of dermal nerve involvement in PKDL has further complicated the issue of differentiating PKDL from leprosy.[9]

The aim of the present communication is to highlight how many cases of PKDL are misdiagnosed as leprosy in an endemic area and how to differentiate both conditions by clinical examination and laboratory investigations. We also describe some uncommon features, namely dactylitis and genital involvement, observed in 1 of the 4 patients.

Case reports

CASE 1

A 20-year-old man, a migrant from Bihar, presented with asymptomatic erythematous papules, plaques and nodules over his face, neck and trunk, with hypopigmented patches on his back of 3 years' duration. He gave a history of kala-azar when he was 5 years old, for which he had received some injections. He was diagnosed as a case of lepromatous leprosy in a hospital in Bihar and was treated with multibacillary WHO multidrug therapy (WHO–MDT–MB), for 1 year, after which he stopped treatment due to a lack of response.

On general examination, he was mildly anaemic, with no jaundice or hepatosplenomegaly. Cutaneous examination revealed diffuse infiltration and erythema over his face and earlobes. There were multiple asymptomatic papules and nodules over his forehead, chin, nose, pinnae, lips and the dorsum of the tongue (Figures 1 and 2). There was a differential involvement of the central part of his face. However, there was no madarosis. Numerous lesions of similar morphology were seen over his neck, trunk and extremities, scrotum and shaft of the penis, with most of the intervening

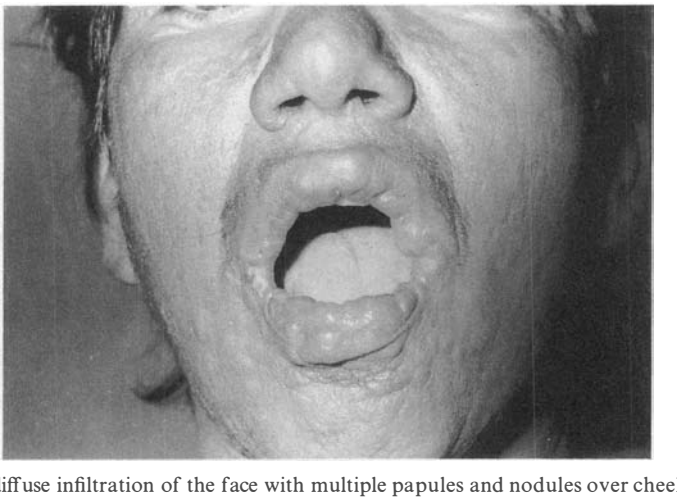

Figure 1. Showing diffuse infiltration of the face with multiple papules and nodules over cheek, chin and lips (Case 1).

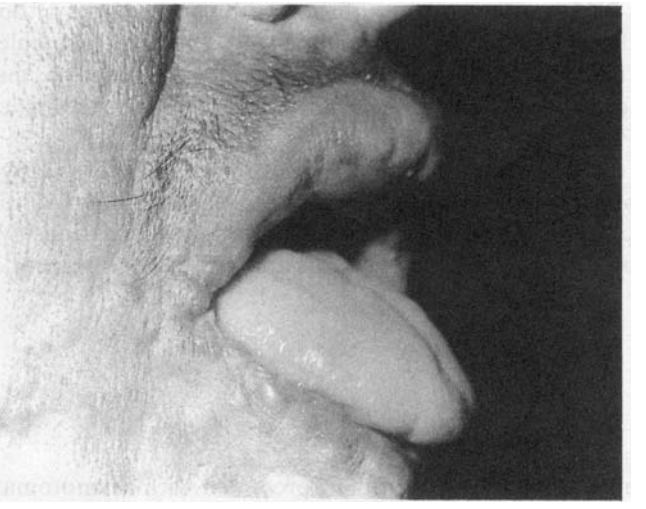

Figure 2. (*Close up)* Infiltrated papules and nodules over lips, lateral border and dorsum of the tongue (Case 1).

areas looking normal (Figure 3). However, the acral part of his extremities were shiny and diffusely infiltrated. There were multiple, well-defined, nonscaly, hypopigmented macules over his trunk causing no loss of sensation. Peripheral nerves were neither thickened nor tender. Some of the lesions in and around his axillae and back showed follicular keratotic plugging. In addition, he had painful fusiform swelling of the right index finger suggestive of dactylitis.

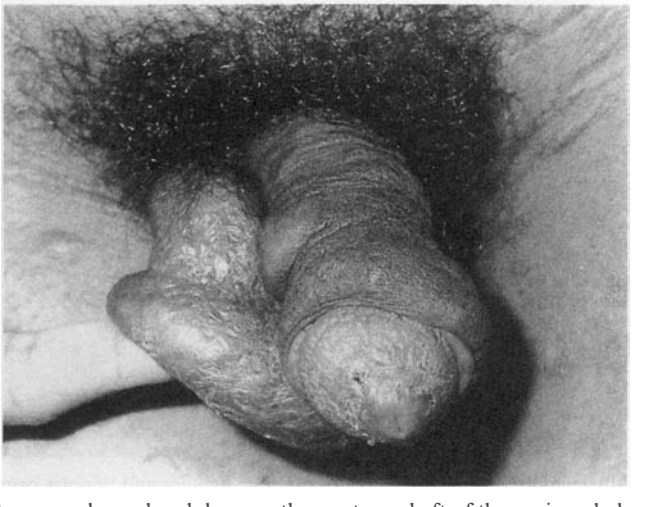

Figure 3. Erythematous papules and nodules over the scrotum, shaft of the penis and glans penis (Case 1).

CASE 2

A 31-year-old man, a migrant from Bihar, presented with multiple erythematous papules, plaques and nodules over his earlobes, face and extremities of 6 years' duration. He had a history suggesting he had suffered from kala-azar twice before, for which he had been treated with some injections daily for 10–12 days each time. He was diagnosed as a case of leprosy for his current symptoms and treated with WHO–MDT–MB in a district hospital with no benefit. Examination revealed similar features to Case 1.

CASE 3

A 25-year-old woman, a migrant from Nepal, presented with multiple hypopigmented macules over her trunk and extremities which had been preceded by a generalized pruritus of 2 years' duration. She had had kala-azar 6 years before, which had been confirmed by bone marrow, and had been treated accordingly.

General examination was noncontributory. Cutaneous examination revealed multiple ill-defined, nonscaly hypopigmented macules of 0·5–1 cm diameter over her face, trunk and extremities. There was no loss of sensation over the macules, or any peripheral loss of sensations or nerve thickening.

CASE 4

A 41-year-old woman, a migrant from Bihar, presented with asymptomatic hypopigmented macules over her trunk and extremities of 3 years' duration. She was diagnosed as a case of leprosy and treated with WHO–MDT–MB for 2 years by a local doctor, with no advantage. A history of kala-azar was available from 10 years before, for which she had been treated with some injections given daily for 1 month.

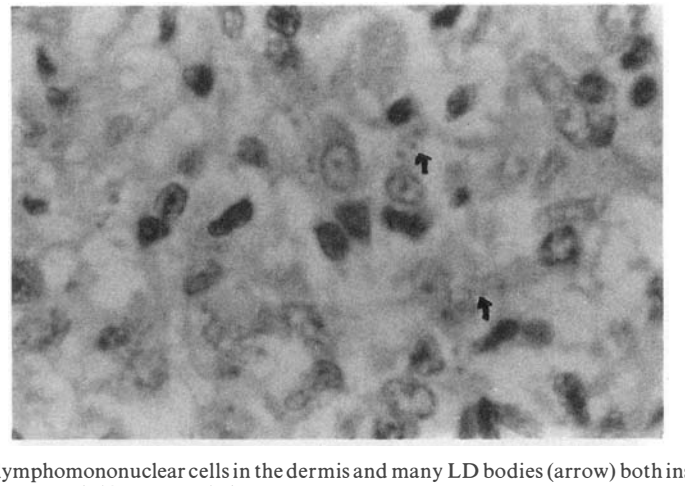

Figure 4. Showing lymphomononuclear cells in the dermis and many LD bodies (arrow) both inside and outside macrophages (H & E × 400) (Cases 1 and 2).

Examination revealed similar features to Case 3. She was diagnosed as a case of PKDL, although borderline lepromatous (BL) leprosy and vitiligo were other possibilities considered.

Slit-skin smears (SSS) from their earlobes, hypopigmented macules and nodular lesions (5 sites) in Cases 1 and 2 and from hypopigmented macules in Cases 3 and 4 were negative for acid-fast bacilli (AFB) or leishmania donovani (LD) bodies. Histopathological examination of the biopsy specimen from nodular lesions in Cases 1 and 2 and hypopigmented macules in Cases 3 and 4 showed flattened epidermis, with dermal infiltrate composed predominantly of lymphocytes and plasma cells. The infiltrate was dense in Cases 1 and 2 and sparse in Cases 3 and 4. Staining with Giemsa showed many LD bodies in Cases 1 and 2 (Figure 4), while none could be demonstrated in Cases 3 and 4. Careful histopathological examination ruled out other clinical possibilities. Except for mild anaemia, all other routine investigations on haemogram, serum biochemistry, urine, stool, skiagram chest and electrocardiogram were within normal limits.

Serum electrophoresis showed hypergammaglobulinaemia in Cases 1 and 2. However, in both cases the aldehyde test was negative and a sea water test was positive. A leishmanin skin test was negative in both these patients. Indirect immunofluorescence (IIF) test using LD bodies as substrate was positive (1 : 200) in Case 2 (Figure 5).

All patients were treated with intramuscular injections of sodium stibogluconate, 20 mg/kg/day. Infiltrated papules and nodules subsided after 1 month and 3 months respectively in Cases 1 and 2. Hypopigmented macules started fading gradually after 3 months of full treatment. There was no relapse of skin lesions in any of the 4 patients during a subsequent follow-up of more than 2 years.

Discussion

PKDL mainly occurs in India, particularly Eastern India, i.e. West Bengal, Bihar and the areas of Nepal adjoining these states. After apparent control, a recent trend of

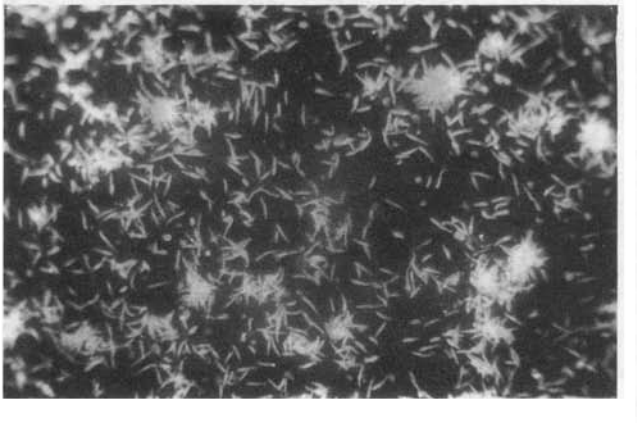

Figure 5. Positive indirect immunofluorescence (IIF) test using LD bodies as substrate (Case 2).

increase in the incidence of PKDL has been noticed in Bihar.[10] (Incidentally 3 of our patients were migrants from Bihar.) Our patients split 50 : 50 men : women, although a female preponderance has been noticed by others.[11] A history of kala-azar was available in all the patients, as observed by other Indian workers.[10] However, in African cases such a history is not always forthcoming.[1,2]

SSS usually yield AFB in almost all LL or BL leprosy cases as compared to PKDL where LD bodies have not been found in more than 60% of cases.[10] SSS were negative for LD bodies in all our patients as has been observed earlier.[12] SSS yield LD bodies mostly from infiltrated lesions, namely papules/plaques and nodules and less frequently from hypopigmented macules.[3,4]

While histopathology of bacillary positive leprosy is quite characteristic, that of PKDL mostly shows nonspecific dermal infiltrate by lymphomononuclear cells.[10] However, epithelioid cell granuloma occasionally found in PKDL may simulate tuberculoid leprosy.[12] While AFB are found in histologic sections in almost every case of LL or BL, LD bodies could be demonstrated only in 50% of cases with PKDL in a large series.[10] In the present report only in Cases 1 and 2 could LD bodies be demonstrated on histopathological examination. With the recent observation of perineural infiltration in PKDL, the issue of differentiating it from leprosy has been further complicated.[9] However, direct and indirect immunofluorescence tests for PKDL can overcome this limitation to a great extent.[2] The face is supposed to be the commonest site for hypopigmented lesions in PKDL.[13] We observed such lesions in 3 of our patients over the face. Though macrocheilia has been described in PKDL by Sen Gupta,[14] nodules over the lips and tongue, as seen in Case 1, are unusual. Similarly dactylitis observed in the same patient is as yet unreported in PKDL to the best of our knowledge, and the occurrence of genital lesions as seen in our patients, though known in patients with LL or BL disease, is extremely rare in PKDL.

It is evident from our patients that papules and nodules respond earlier and better to stibogluconate as compared to hypopigmented macules, which require at least 3 months to show improvement. This has been observed before.[15]

Cases 1, 2 and 4 were misdiagnosed as having leprosy and treated with antileprosy drugs. This is quite a common error since both leprosy and PKDL have many features in common[16,17] and both diseases are prevalent in the same geographical areas. However, the absence of madarosis in the presence of facial infiltration (seen in Cases 1 and 2), intact sensations over lesions and peripheral parts, the absence of nerve thickening and tenderness are some clinical pointers towards a diagnosis of PKDL. SSS is a simple procedure which can be carried out in the outpatient department to overcome the problem in many cases.

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Letters to the Editor

PROTECTIVE FOOTWEAR FOR LEPROSY PATIENTS WITH SOLE SENSORY LOSS OR ULCERATION OF THE FOOT

Sir,

We would like to respond to the letter on this topic published in *Lepr. Rev.* (1994) **65,** 400–402. We agree with the need for protective footwear and ALERT has a well-equipped orthopaedic workshop employing 15 technical staff. We have supplied MCR sandles, plastazote shoes and boots as well as lower limb prostheses, as necessary, for many years.

In recent years we have found that it is impossible to supply these in sufficient quantity for all the former patients who need them. We have also noted some of the problems found in India and reported by Dr Krishnamoorthy, especially an unacceptable design causing greater stigma for people affected by leprosy. Because of infrequent use many patients have not been helped by their shoes. An additional problem has been that shoes made far from the patient's home may not be properly fitted or reviewed and may actually cause new ulcers.

Amidst this rather depressing scenario we are attempting to do more education in selfcare, to get patients to take greater responsibility for their own feet. However, we have been very encouraged by the initial results of using canvas shoes produced by a commercial company here in Addis Ababa. They were able to make a new design incorporating an MCR layer and these shoes are sold at a subsidized price to patients. We are currently discussing with the manufacturer how the upper canvas part can be strengthened as durability is a problem. Different models for men, women and children are available.

We have just started a study to compare canvas shoes with plastazote shoes for patients with damaged feet and hope to report the results within one year, including the relative costs. In the meantime we have already noted a vast difference in acceptability and a number of chronic ulcers have quickly healed with the canvas shoes. It seems likely that a more attractive shoe helps to develop a more positive attitude in patients, as well as providing some physical protection for the feet.

PAUL R. SAUNDERSON, GIRMA SEBOKA

Leprosy/TB Control Division
ALERT
P.O. Box 165
Addis Ababa
Ethiopia

DOES LOSS OF NERVE FUNCTION EQUAL PURE NEURITIC LEPROSY?

Sir,

When your patient is carried into the clinic semiconscious on a stretcher and you can not feel his pulse, you know *he* is in trouble: cholera? septicaemia? a haemorrhage? . . . When your patient strides into the clinic greeting you heartily, and you can not feel his pulse, you know *you* are in

trouble! Unable to feel pulses, I substituted for a while by auscultation of the heart and measuring blood pressure (one obtains much the same information with more effort). When I was unable to detect thickened nerves by palpation, I was worried. For a few days I paid close attention to my hands as I carried out daily work. I realized that everything I touched felt the same: smooth/rough, hard/soft, hot/cold, sharp/blunt. One day I spilled near-boiling water onto my own fingers and felt nothing in my burnt hand, only alarm in my mind. I had not only lost sensory discrimination but also protective sensation. This was serious, so I shared the discovery with a colleague. My attention was then drawn to the fact that my feet also had become numb.

Had I presented at an average rural clinic in this part of the world with my 'glove and stocking anaesthesia', and a history of many years' occupational exposure to leprosy, it is likely that the local Leprosy Supervisor would have labelled me as 'pure neuritic leprosy'. I would have been condemned to 24 months of MB-MDT. Being a foreigner, I went, not to the nearest clinic, but instead to the physician at our district's general hospital. After a thorough physical examination and numerous tests (including a skin smear) he was able to reassure me that it was an isolated sensory neuropathy almost certainly attributable to a medicine I had taken for unrelated reasons.*

I was lucky that in my case the neuropathy was a reversible condition. Now that it is partly recovered, I have been forcefully reminded that different modalities of sensation can be lost and regained at different rates. Long after acquiring the ability to feel 'light touch', I am still unable to distinguish between heat and cold. I still do not know if something is sharp enough to cut my skin.

I was lucky: I already knew how to prevent injuries to my hands and feet. I was lucky too that I escaped from being registered as a leprosy patient. I have been spared the necessity of attending a leprosy clinic monthly for 2 years and the risk of side-effects from antileprosy drugs (which would not have helped my condition).

This letter is submitted in the hope that it will remind field workers to be very cautious about diagnosing anyone as 'pure neuritic leprosy' simply on the basis of loss of nerve function. It happens often in this country, probably elsewhere. The standard question for 'drug history' at a leprosy clinic (Did you ever take antileprosy medicine before?) is inadequate. We need to ask, 'Did you take any medicine for any reason?'. The standard testing for sensation in a leprosy clinic is often confined to light touch (by feather or ballpen or filament). If this is normal, we need to remember that a patient may still have impairment in other modalities of sensation. This is relevant not only at the time of diagnosis but also in deciding whether a patient has 'recovered' from an attack of neuritis.

Anandaban Leprosy Hospital CYNTHIA R. BUTLIN
Post Box 151
Kathmandu
Nepal

RECORDING OF THE DISABILITY INDEX

Sir,

Recording of the disability index is common in follow-up studies. Usually the disability grade is recorded as a single figure. It is not clear when this is understood as a numerical average of the

* This drug was 'Maloprim' (made by Wellcome, UK). It contains dapsone 100 mg and pyrimethanine, 12·5 mg and is taken once weekly. I took it for one month as malaria prophylaxis in January 1995.

standard 6 digit disability index, as recommended by WHO, or as the highest single digit. In either case it is misleading and meaningless. The numbers from 0 to 3 are not, and never were intended to convey a numerical sequence. In fact in the very early days we did consider using other symbols, exactly to avoid such misunderstandings. It is obvious that no numerical average can be calculated from such 'sequence'.

Calculation of an 'average' between loss of corneal sensation, clawhand, and plantar ulceration is nonsense.

The single highest figure is a slightly better indicator of disability. Still it does not allow for the great and important difference in the actual management of patients with disabilities of eye, hand, or foot. Neither does it show a possible multiple disability. I suggest that the rational use of a disability index is to record the full 6 digit disability index. With modern computer analysis it is simple to extract much relevant information of the greatest importance both for evaluation of a project and for planning of future prevention and treatment of disabilities.

Braine Parken 85,
DK 6100 Haderslev,
Denmark

JOHS G. ANDERSEN

BORDERLINE LEPROMATOUS LEPROSY MASQUERADING AS LYMPHOCUTANEOUS SPOROTRICHOSIS

Sir,

G.S. a 51-year-old office worker from Northern India, reported with asymptomatic nodular-plaque lesions of 3 months duration of the right hand. Initially he noticed a solitary pea-sized erythematous nodule over the dorsum of the right hand near the base of the ring finger. The lesion grew insidiously and changed into a nodular-plaque lesion over a period of 3 months during which he also noticed a similar lesion near the wrist joint. There was no history of trauma at the site of initial lesion. Cutaneous examination revealed two non-tender, dull red, nodular-plaque lesions $3 \times 2{\cdot}5$ cm each, with well-defined borders and shiny stretched overlying skin over dorsum of right hand and wrist (Figure 1). On examination a cord-like structure was felt between the two lesions. A differential diagnosis of lymphocutaneous sporotrichosis and atypical mycobacterial infection with organisms like *Mycobacterium marinum*, *M. kansasii* and *M. chelonei*[1–8] was entertained. A biopsy was taken from the lesion of the right hand and sent for histopathological examination, fungal and AFB culture.

A haematoxylin and eosin stained section from the lesion showed thinning of the epidermis, preserved grenz zone and a diffuse collection of foam cells and lymphocytes in the dermis. Stain for lepra bacilli was positive. Culture for fungus and AFB was negative. A slit-skin smear examination done subsequently from the lesions revealed a bacillary-index of 2+. X-ray of the right arm and forearm did not reveal any bony abnormality. Upon testing of sensations, a loss of 10–20% was detected to all modalities over the lesions while no peripheral loss of sensation was found.

Hence a diagnosis of borderline lepromatous leprosy restricted to one anatomical area with involvement of a cutaneous twig of the ulnar nerve was made based upon the histopathological findings and the patient was put on MDT MB (WHO) regimen.

Within two weeks of initiation of therapy he developed Type I reaction manifested by features of neuritis (pain in the cutaneous twig), lesional tenderness with bright red erythema and swelling of the lesions along with swelling of the dorsum of the right hand. He also developed two similar nodular-plaque lesions of the medial aspect of the forearm in a linear alignment with the previous two lesions with progressive thickening of the proximal part of the nerve (Figure 1). MDT–MB was continued and tablet prednisolone 30 mg once daily was added along with splintage of the right upper limb. Though the Type I reaction subsided, the cutaneous lesions and thickened nerve

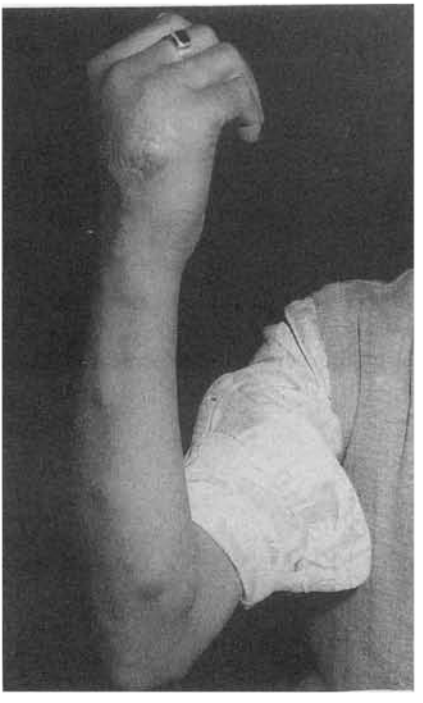

Figure 1. Nodular-plaque lesions of the hand and wrist in a linear arrangement.

remained unchanged over 6 weeks. So, tab prefloxacin 400 mg b.d.* was added and was given for 4 weeks to which the lesion responded dramatically with flattening of the nodular-plaque and significant subsidence of nerve thickening.

Nerve involvement in leprosy is one of the diagnostic criteria as proposed by WHO[9] but development of nodular-plaque lesions along a nerve, exactly mimicking lymphocutaneous variety of sporotrichosis is almost unheard of. Excellent response to prefloxacin makes this rare presentation even more interesting.

Department of Dermatology and Pathology, Govt. Medical College, Sec. 38 and Dept. of Dermatology, PGIMER, Sec. 12, Chandigarh, India

S. D. MEHTA, †U. HANDA, G. DAWN, S. HANDA & I. KAUR

†Correspondence to: Dr S. D. Mehta, Dept. of Dermatology, Govt. Medical College, Sec 38, Prayas Building, Chandigarh, India.

*(Pefloxacin Mesylate dihydrate is marketed as 'Tab Proflox 400 mg' by PROTEC Division of Cipla Ltd, and Manufactured by CIPLA Ltd, Virgo Nagar, Bangalore 560 049).

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PENTOXIFYLLINE MAY BE USEFUL IN THE TREATMENT OF TYPE 2 LEPROSY REACTION

Sir,

Leprosy reactions (LR) are among the most significant complications during the development of leprosy.

Up to now thalidomide and cortisone are the main drugs used in the treatment of Type 1 (reversal reaction) and Type 2 (erythema nodosum leprosum) LR.

Thalidomide and cortisone are the drugs of choice in the treatment of erythema nodosum leprosum (ENL), and cortisone is the only treatment for reversal reaction. The results are quite good with these drugs, but, side-effects are significant. Mainly for this reason the World Health Organization (WHO) recommended that, 'priority should be given to finding an acceptable alternative to these drugs'.[1]

According to present knowledge pentoxifylline (PF) could be useful in the treatment of LR[2,3] because it interferes on the level of TNF-alfa and IL-1. TNF-alfa and IL-1 are probably associated with the development of leprosy reactions.[4]

Pentoxifylline (Trental®), also known as 1-(5-oxyohexyl)-3,7 dimethylxanthine, 1-(oxyohexyl) theobromine, is a methylxantine derivative with properties similar to theobromine, caffeine, and theophylline.[2,3] It has potent haemorrheologic properties. Although doctors using a new drug are under an obligation to check the contraindications, it may be helpful if the authors included a short note that oxpentifylline is contraindicated in patients who show drug allergy to theophylline and caffeine, and that care should be exercised in patients with coronary artery disease or orthostatic hypotension, as the drug has a hypotensive effect.

Recently we observed a patient with Type 2 reaction treated with PF.[5] The good results prompted us to treat more LR patients with PF.

From July 1994 to January 1995 we treated a further 8 patients presenting with Type 2 and Type 1 reaction with PF.

Patients and methods

Four patients with Type 2 reaction and 3 with Type 1 reaction were treated with oral pentoxyfilline (400 mg three times a day). Another patient with Type 2 reaction started with the same dosage but as no response was observed the patient received IM injections of 100 mg PF, 3 times a day, for 3 days followed by oral PF, 400 mg four times a day (see Table 1).

Table 1. Summary of clinical data and efficacy of pentoxifylline in the treatment of lepra reaction.

Patient no.	Sex	Age (yr)	Classification LL or B*	Type of reaction	Efficacy of pentoxifiline
1	m	19	LL	Type 2	good
2	m	25	LL	Type 2	good
3	m	42	LL	Type 2	good*†
4	m	70	LL	Type 2	good
5	m	28	LL	Type 2	good
6	F	44	BB	Type 1	fair
7	M	47	BV	Type 1	no response
8	M	40	BV	Type 1	no response

* LL, lepromatous leprosy; B, borderline leprosy.
† This patient failed to respond to pentoxifylline 400 mg/three times a day but improved with injections of 100 mg every 8 hours for 3 days followed by oral PF 400 mg/four times a day.

Reactions were diagnosed clinically, and bacilloscopies and biopsies were performed for all of the cases. These patients were under treatment or had completed multidrug therapy (MDT).

ENL or Type 1 plaque lesions were disseminated. Fever, malaise and joint pain were associated with ENL.

No patient had significant nerve enlargement or other indications for urgent treatment with cortisone.

Results

All patients but one presented with progressive regression of ENL related symptoms such as fever, malaise and articular pain in 2 to 5 days, and involution of ENL lesions was observed in 2 to 4 weeks.

A patient with Type 2 reaction that did not improve with 400 mg, 3 times a day, responded well to three intramuscular (IM) injections a day of 100 mg PF, for 3 days, followed by oral PF, 4 times a day.

In only one patient with Type 1 reaction was there a slow regression of plaque lesions.

No side-effects related to PF were observed.

Discussion

In spite of the efficacy and good tolerance of WHO–MDT, LR still represents a serious constraint during the development of leprosy. The well known side-effects of thalidomide and cortisone, the two main drugs used in the treatment of leprosy reaction, constitute the main difficulties in the management of LR.

Therefore, there is an urgent need to find alternative drugs for the treatment of LR.

According to Sarno[4] the elevated concentrations of TNF-alfa and IL-1 may be implicated in LR.

Pentoxifylline should be an alternative drug for the treatment of LR because this agent suppresses monocyte production of TNF-alfa and inhibit leukocyte stimulation by TNF-alfa and IL-1.[6,7]

In a previous report[5] we treated a Type 2 reaction with PF. The good response of joint pains and malaise followed by a progressive involution of ENL lesions prompted us to treat further LR patients with PF.

The treatment of LR with PF gave satisfactory results particularly in Type 2 reaction. The

general symptoms improved in 2 to 5 days and ENL progressively disappeared in 2 or more weeks.

The results observed in Type 2 reaction are less impressive than those verified with thalidomide or cortisone but it does seem to be an alternative treatment.

The progressive regression of Type 1 reaction in 1 patient could be a spontaneous regression and so far it is very difficult to affirm that improvement was related to PF. After 3 days of PF treatment the reversal reaction lesions did not change or worsen in 2 of the patients. Thus we interrupted PF and cortisone was introduced.

According to the present observations, it seems that pentoxifylline must be used for weeks or months for the effective control of Type 2 reaction, more or less in the same way as we do with thalidomide. Our follow-up is limited to 2–4 months.

We think it is necessary to utilize higher dosages of IM pentoxifylline for the treatment of patients with severe Type 2 reactions or cases that do not improve with standard recommended doses of PF.

In conclusion, according to the present study, pentoxifylline demonstrated interesting effects on the treatment and control of Type 2 reaction and should be better studied as an alternative drug for the management of leprosy reactions.

Department of Tropical Dermatology, Institute of Tropical Medicine, University of Amazonas Manaus-Am, Brazil

SINÉSIO TALHARI,*
ANA TEREZA ORSI,
ANETTE CHRUSCIAK TALHARI,
FRANCISCO HELDER C. SOUZA,
LUIS CARLOS DE LIMA FERREIRA

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* Correspondence: Dr S. Talhari, Av. Japura 572, Manaus-Am, Brazil.

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Book Review

Peripheral Neuropathy—The Continuing Challenge. **A Doctoral Thesis for the University of Utrecht.**
Willem Herman van Brakel (1994)

The underlying hypothesis of this thesis, reprinted in full, is that early detection and treatment of neural impairment are the keys to preventing disabilities in leprosy. It opens with outlines of the topics investigated, followed by a review of the nature of the disease, its epidemiology, clinical features, diagnosis, immunology, classification of the various forms and finally an account of the pathology, methods of assessment and recording of neurological complications. One of the main purposes of the work was to determine the reliability and repeatability of simple but objective clinical tests that can be applied in the field or in areas where sophisticated equipment and services are not available. In this it succeeds.

This thorough study has two main parts, each with five chapters. The format of all but the last chapter, which is a general summary with discussion and conclusions, follow a set pattern. Initially a summary sets out aims, methods, results and conclusions. The following introduction, includes a detailed account of methods and rigorous statistical treatment of findings. The results are discussed, conclusions are drawn and each chapter has its own bibliography. If a second edition is required a detailed index and a single bibliography in alphabetical order would be most helpful.

The first part reports the results of retrospective studies on 536 patients registered at Green Pastures Hospital, Pokara, Nepal during four years. All were new patients, 396 were previously untreated and 140 were referred for treatment of reactions and/or neural impairment. Where slit skin smear services are not readily available, evidence indicated that a classification based on purely clinical criteria was a sensitive indicator of multibacilliary leprosy, expediting early institution of multidrug therapy. The epidemiology of neuropathy, its risk factors, and response to steroid treatment and the early detection of the so-called silent neuropathy (as yet unnoticed by the patient), are covered in this section.

The second part of the book establishes:

1. Normal sensory thresholds for standardized monofilaments, moving two point discrimination, dot detection, tactile recognition of objects, discrimination of size and texture for the 99th percentile of 136 healthy Nepalese volunteers. Effects of age, sex, side, occupation, smoking and consumption of alcohol were examined with logistic regression.
2. Sensitive, simple and appropriate tests for effective early screening for neuropathy.
3. The intra and inter observer reliability of sensory testing.
4. The practical value gnostic sensibility (recognition of objects by touch) in leprotic neuropathy.

Pressure of work and other factors may make it impractical to map out areas of sensory loss, but arbitrary selection of isolated areas is not ideal with heterogeneous changes in nerve trunks. Contractures of muscles and joint capsules, major causes of disability, merit separate recording. These are minor criticisms of an admirable piece of clinical science based on experience, common sense and practical concern for the welfare of patients.

Ruth E. M. Bowden

ISBN-90-393-0973-6 p.217. 45 tables, 30 figures, 424 references.

Lepr Rev (1995) **66,** 265–269

Teaching Materials and Services

Chemotherapy of leprosy: new recommendations from WHO

KEY RECOMMENDATIONS

The report of the WHO Study Group on Chemotherapy of Leprosy, which met in Geneva on 1–5 November 1993, has now been published in the WHO Technical Report Series (TRS 847, 1994). The group extensively reviewed experiences with WHO/MDT, considered recommendations regarding the use of new anti-leprosy drugs and possible changes in the operational aspects of leprosy chemotherapy, and sought to identify future research needs in order to improve the chemotherapy and control of leprosy. Among its conclusions and recommendations are the following:

DURATION OF TREATMENT:

Multibacillary leprosy:

The WHO-MDT regimen for multibacillary leprosy has been very successful and has been widely implemented as recommended. Most data on the effects of limiting therapy to a 24-month course of WHO-MDT—rather than continuing until skin smears are negative—are favourable. It is therefore recommended that all multibacillary patients be given the standard WHO regimen for 24 months, since such a change is considered safe and will increase the use of the regimen under field conditions.

Paucibacillary leprosy:

The 6-month WHO-MDT regimen for paucibacillary leprosy has yielded excellent results wherever it has been appropriately used, and there is no convincing evidence to suggest that it should be extended beyond six months.

CLASSIFICATION:

Classifying patients through skin smear examinations should be continued. Where reliable facilities for the bacteriological examination of skin smears are not available, approaches based on clinical classification may be required. When classification is in doubt, the patient should be treated as having multibacillary disease.

REGULARITY OF TREATMENT:

Regularity of treatment requires that the multibacillary patients should receive 24 monthly doses of MDT within 36 months and paucibacillary patients six monthly doses within nine months. If

any patients drop out before completion of therapy, they should be re-evaluated when retrieved to determine whether further treatment is needed.

FOLLOW-UP AFTER COMPLETION OF THERAPY:

Because the risk of relapse after completion of the WHO-MDT regimen has been shown to be negligible, it is no longer necessary to continue routine annual surveillance of patients. Instead, patients should be taught, at the time of release from treatment, to recognize the early signs of possible relapse or reaction and to report promptly for treatment.

ALTERNATIVE DRUG REGIMENS FOR PATIENTS FACING SPECIAL PROBLEMS:

Resistance or toxicity to rifampicin:

For multibacillary patients who have rifampicin-resistant *M. leprae* or who have shown toxic effects to rifampicin, the Study Group recommended daily administration of 50 mg of clofazimine, together with two of the following drugs—400 mg of ofloxacin, 100 mg of minocycline, or 500 mg of clarithromycin—for six months; followed by daily administration of 50 mg clofazimine, together with 100 mg minocycline or 400 mg of ofloxacin for an additional period of 18 months. These should be administered under regular supervision in a leprosy referral centre.

Severe dapsone toxicity:

If any patient shows severe toxic effects to dapsone, the drug treatment with dapsone should immediately be stopped. No further modification of the regimen is required for patients with multibacillary disease. However, clofazimine in the dosage employed in the standard MDT regimen for multibacillary disease may be substituted for dapsone in the regimen for paucibacillary disease for a period of six months.

Refusal to accept clofazimine:

When clofazimine is totally unacceptable owing to pigmentation of the skin, 400 mg daily ofloxacin or 100 mg daily minocycline may be substituted for the clofazimine. In view of the severe hepatotoxicity of ethionamide and protionamide, these drugs should no longer be recommended as substitutes for clofazimine. Because of the limited information available, new drugs should be administered only under supervision in a referral centre.

FACILITIES FOR BACTERIOLOGICAL EXAMINATION:

A service for the bacteriological examination of skin smears is not a prerequisite for initiating an MDT programme. In view of the increasing prevalence of human immunodeficiency virus (HIV) infection and hepatitis B infection in many countries where leprosy remains endemic, the number of skin-smear sites and the frequency of smear collection should be kept to a minimum.

Source: *LEP News*, Vol. 3, No. 2, November 1994. WHO Action Programme for the Elimination of Leprosy, 1211 Geneva 27, Switzerland

Risk of relapse in leprosy. WHO/CTD/LEP94.1

The above paper prepared by the Leprosy Unit, WHO, reviews in detail the risk of relapse

following WHO-recommended multiple drug therapy (MDT). The results have been extremely favourable and the main points of the paper are as follows:

(a) The most significant result is that the risk of relapse is very low, both for MB and PB patients, after completion of MDT.

If we assume that all the biases and limitations which could possibly affect the results of this study were also, to a large extent, applicable to studies on relapses occurring after monotherapy with dapsone, then we find that the risk of relapsing with MDT is at least 10 times less than with dapsone monotherapy.

(b) There is strong evidence that in MB patients, 50% of relapses occur within the first three years after stopping MDT, and 75% within 6 years. Among PB patients, 50% of relapses occur within $2\frac{1}{2}$ years and 75% of relapses within 5 years.

Moreover, there are indications that in both MB and PB patients the annual risk of relapse does not increase over time. In other words, if in an individual patient the disease does not relapse within the first 5–6 years, then his/her risk of relapsing is negligible.

(c) With such a low risk for relapse and since the majority occur within a few years after stopping MDT, there is definitely no need to have long-term active post-MDT surveillance of patients for the purpose of detecting relapse. In other words, patients can be declared "cured" after completion of treatment.

(d) The protective effect of MDT in preventing post-treatment relapses as compared to dapsone is more than 90%. In other words, it can be estimated that the introduction of MDT has probably prevented close to half a million relapses during the last decade.

Applied field research, TDR

TDR News, October 1993, describes the new structure of TDR(UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases) and describes the function of its Applied Field Research Unit. Priority topics for TDR-funded applied field research are:

Disease control within existing health care systems

- preventive measures, for individuals and communities, against malaria infection and disease
- optimal combinations of measures to interrupt *Trypanosoma cruzi* transmission in human populations
- cost-effective strategies for the prevention and treatment of schistosomiasis and managerial tools for its control
- strategies for using ivermectin in the control of onchocerciasis (river blindness) in Africa
- malaria case management, particularly in children and women, in hospitals and at the "periphery" of the national health system
- new strategies for improving the organization and management of control programmes
- better detection and treatment of leprosy
- integrated control of visceral leishmaniasis through interventions targeted to children
- feasibility and cost-effectiveness of tools and strategies for the control of lymphatic filariasis
- integration of tropical disease control into primary health care systems and the sustainability of disease control programmes
- improving systems of health care delivery for better control of tropical diseases
- systems of drug delivery for diseases requiring repeated mass treatments
- ivermectin-based strategies for eliminating onchocerciasis in the Americas
- field-testing of new tools for the control of lymphatic filariasis
- feasibility and cost-effectiveness of different drug treatment regimens for leprosy
- optimization of current drug treatment regimens for African trypanosomiasis

- early identification and correct management of impaired nerve function in leprosy with a view to prevention of deformities.

Heath care financing
- impact of changes in financing mechanisms on the availability of funds for the control of tropical diseases, on treatment-seeking behaviour and on prevention of disease
- perceptions, by health care providers and communities, of the impact of changes in financing mechanisms
- the role of the nongovernmental sector in the control of tropical diseases
- improving control of tropical diseases, where possible, through a mix of public and private sector involvement in health care provision and financing.

Gender and tropical diseases
- women's recognition and understanding of disease, including malaria, schistosomiasis, African trypanosomiasis and Chagas disease
- operational research to improve the services and care provided to women by health centres
- cultural obstacles to women's access to and use of treatment facilities
- gender differences that relate to stigma associated with tropical diseases (notably, leprosy, cutaneous leishmaniasis, lymphatic filariasis and schistosomiasis) and that hamper early detection of these diseases.

Environmental and demographic changes
- migration and environmental changes (using, among other things, geographical information systems) and their effects on leishmaniasis
- disease control in situations of rapid socioeconomic, demographic and environmental change
- the effect of ecological changes on the transmission of vector-borne diseases
- agricultural development and rice growing as related to malaria and schistosomiasis.

Information-education-communication (IEC) from the perspectives of communities and policy makers
- IEC strategies for tropical disease control
- community compliance and participation in disease control efforts
- the school as an entry point for tropical disease control
- health promotion, directed to women as key health providers, in the control of leishmaniasis.

Rapid assessment procedures (RAPs)
- development of RAPs to determine the distribution of diseases requiring intervention at the community level
- development to RAPs to monitor and evaluate disease control efforts
- cost-effective strategies for community and individual diagnosis of schistosomiasis.

Surveillance and impact assessment
- local and national surveillance and health information systems, especially for malaria
- epidemiological modelling for disease surveillance and control
- cost-effective surveillance for the control of African trypanosomiasis: methods and managerial tools
- socioeconomic and public health importance of lymphatic filariasis
- epidemiological assessment of schistosomiasis morbidity and the impact of efforts to control it.

Source: TDR Communications, WHO 1211 Geneva 27, Switzerland

All Africa Leprosy and Rehabilitation Training Centre

TRAINING CALENDAR 1996

Jan 29–Mar 8 Prevention and Management of Disabilities
Course aimed at qualified physiotherapists and occupational therapists as well as experienced leprosy workers involved in the prevention and care of disability. Emphasis on POD programme management and disability problem solving.

Mar 11–Apr 12 Management of Combined Leprosy and TB Control Programmes
Course aimed at physicians and senior paramedical staff involved in managing a combined programme at the regional or national level.

Apr 15–Apr 26 Training Methodology
Course aimed at senior staff involved in human resource development. Emphasis on curriculum planning, learner centred teaching methods, appropriate teaching tools and course assessment.

May 6–May 24 Tuberculosis Control for Physicians
Course aimed at physicians newly involved in TB control, especially those working in leprosy programmes recently combined with TB. Emphasis on programme management.

Jun 10–Jun 22 Essentials of Leprosy and TB for Non-Medical Staff
Course aimed at non-medical managers and administrative staff working in Leprosy and TB programmes or donor agencies. Objectives: to gain a better understanding of the two diseases, to communicate more efficiently with the medical staff and to contribute more effectively in decision making and priority setting.

Aug 5–Aug 16 Social Rehabilitation
Course aimed at both general and leprosy workers involved in social rehabilitation. Emphasis on community participation, sustainability and independence.

Aug 26–Sep 6 Tropical Dermatology
Course aimed at physicians with experience and/or special interest in the diagnosis and management of skin diseases in Africa.

Sep 16–Oct 25 Essentials of Leprosy and TB for Physicians
Course aimed at physicians with limited experience in either leprosy or TB. Emphasis on clinical aspects and programme management.

Oct 28–Dec 13 Supervision of a District Leprosy and TB Control Programme
Course aimed at experienced paramedical workers responsible for leprosy and TB control at the district (or equivalent) level. Emphasis on programme management, with special attention on supervision and evaluation.

In-service Training
To be arranged on an individual basis.
Duration and content in function of experience and interest of trainee.
Possible subjects: physiotherapy, surgery, laboratory, dermatology, ophthalmology, etc.

A more detailed training brochure will be sent upon request.

For further information, please contact: The Director of Training, ALERT, P.O. Box 165, Addis Ababa, Ethiopia.

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News and Notes

TB. A global emergency, WHO, July 1994

Dr Arata Kochi, Programme Manager, Tuberculosis Programme, WHO, CH-1211 Geneva 27, Switzerland, has recently circulated a '*WHO Report on the TB Epidemic*' (28 pages) describing the appalling extent and seriousness of the current world TB situation. His opening page reads as follows:

'Tuberculosis is one of the world's most neglected health crises. In spite of its alarming danger, surprisingly little action has been taken to address the TB epidemic. TB has been a low priority on the world's health agenda.

Every day, I ask why this situation is allowed to continue.

Is it possible that no one really cares whether *30 million people* will die in the next decade from TB?

How can TB be such a neglected priority, when *TB is one of the most cost-effective adult diseases* to treat?

How can one ignore *a germ that infects a third of the world's population*?

The numbers are so staggering that I suspect we can't grasp their full impact. Can we really believe that millions of people are dying from TB each year when an inexpensive cure is available? Can we comprehend the magnitude of this injustice?

Perhaps it would be more helpful to think of what it means to let one person die from TB, instead of the faceless millions—to realise that this person has a family, hopes and dreams. Who would refuse to spend *$30—the cost of TB medicines in many countries*—to save this human life?

Dramatic action is needed to end this apathy—whether it is for the sake of one person or 30 million.

In April 1993, WHO declared a global TB emergency. This report will document, in specific terms, what steps must be taken to address the TB epidemic.

For those with TB, the battle is half won. They don't need to wait for a cure: one already exists that is 95 percent successful.

What is needed now is coordinated, responsible action by people in governments, foundations, multilateral organizations, corporations and NGOs who can finance and implement more TB treatment programmes.

The growing TB epidemic is no longer an emergency only for those who care about health, but for those who care about justice.'

Page 4 draws attention to the implications of the 'TB and HIV Co-Epidemic':

'The human immunodeficiency virus is a nightmare-come-true for TB control workers and patients. Even though a third of the world's population is infected with TB, most people never become sick because their immune system keeps the TB germ in check. HIV destroys those cells that keep the TB germ in check.

While TB/HIV co-infection currently produces just a small percentage of all TB deaths, it is one of the most rapidly growing factors in the TB epidemic. In 1990, TB/HIV co-infection was present in four percent of all TB cases. By the year 2000, co-infection will dramatically increase to nearly one in seven of all TB cases.

The TB/HIV co-epidemic is already underway in Africa, and the impact has been devastating. Since the late 1980s, the annual number of TB cases with HIV co-infection has nearly tripled in Zambia and more than doubled in Malawi. Deaths from TB among those who are co-infected have skyrocketed. Asia should be bracing itself for a similar TB/HIV co-epidemic: it already has two-thirds of all TB infections, and now HIV is spreading rapidly there. In 1990, it was estimated that only one percent of all TB cases in the region were attributable to HIV infection. That proportion may reach 10 percent by the year 2000.'

Page 25 lists 'Urgent priorities for 1994–95':

In the next two years, the TB Programme will be helping additional nations become more effective at controlling TB. To meet this objective, the TB Programme will need to address a number of critical challenges.

- Creating political will to address TB. The help of journalists, advocacy organizations, corporations, and health and public interest groups is needed to encourage governments to respond to the TB crisis.
- Disseminating WHO's TB treatment policies. Most of the world's doctors, nurses and health workers are not familiar with WHO's policies for controlling TB. More workshops and training materials are needed to educate key health workers in the worst-affected countries.
- Assisting additional nations. More extensive technical assistance and financial support needs to be provided to more nationals. A number of new countries need to be targeted, including Pakistan, Viet Nam, Nigeria, Indonesia, Mexico, the Philippines, Ethiopia and Romania. Two of WHO's regional offices were recently strengthened with TB advisors. Establishing posts for a TB advisor in Southeast Asia, the Americas and the Eastern Mediterranean is a top priority.
- Focusing donor funds on priority TB projects. TB can be substantially reduced as a threat, provided that foreign aid agencies and multilateral organizations take a leadership role in funding important projects.
- Improving drug supplies. So that essential TB drugs are always available, many national control programmes need to develop coherent drug supply policies, be guaranteed an adequate supply of funding, and improve procurement and distribution procedures.
- Producing a simple and rapid test to improve TB diagnosis. While effective diagnostic tools already exist, they must be improved. A more sensitive and reliable test is needed to identify TB illness in its earliest stages.
- Developing better methods of treating TB in countries with high rates of HIV infection. A drug called thiacetazone has been a mainstay of TB treatment in Africa, even though it can cause severe and sometimes fatal reactions in an unacceptably high proportion of HIV-infected TB patients. It is important that ways be found to help nations switch to safer drugs. The TB Programme is working closely with WHO's Global Programme on AIDS to fund research and projects in areas vital to fighting the TB/HIV co-epidemic.

Page 11 graphically illustrates the differences in external aid (millions of dollars spent in 1990) on leading infections and parasitic diseases: $185 million on AIDS and sexually transmitted diseases; $77 million on tropical diseases (trypanosomiasis, Chagas Disease, schistosomiasis, lymphatic filariasis and leishmaniasis), $55 million on diarrhoea; $47 million on malaria and only $16 million on TB.

The whole document (WHO/TB/94.177) has enormous implications for all working in tropic disease control and should be studied in the original.

The Heiser Program for research in leprosy and tuberculosis

The Heiser Program for Research in Leprosy, initiated in The New York Community Trust in 1974, has awarded over 125 postdoctoral fellowships and research grants over the past 17 years.

The Program's scope has now been extended to include research in tuberculosis. A number of factors influenced this decision.

Tuberculosis, long a major infectious disease in the developing word, causing 3 million deaths each year, is now sharply on the rise in the industrial nations. Furthermore, much of this disease is being caused by bacteria that are resistant to the commonly used antibiotics. It is now clear that the bacterial agents, *Mycobacterium leprae* and *M. tuberculosis*, are closely related and have similiar antigenic components. Thus, the search for effective means of immunization may well follow a common path for the 2 diseases. In light of these developments, a number of laboratories concerned with leprosy research are concurrently engaged in work on tuberculosis, and it seems logical to foster this combined attack.

The Heiser Program will thus continue its support of leprosy research, and at the same time will accept applications for the support of research on tuberculosis.

The Awards

In accordance with Dr Heiser's stipulation at the time that he set up his fund in The New York Community Trust, the income is used not for treatment of patients but for basic laboratory research directed at a better understanding of the discases and their bacterial agents. The ultimate aim is to find measures for the prevention and cure of these diseases that will serve to bring them under control, and 2 types of awards have been established to foster these objectives: (1) postdoctoral fellowships, designed to attract qualified and highly motivated young biomedical scientists to train in the relevant fields of research; and (2) small research grants that will support the training efforts of laboratories involved in research on leprosy and/or tuberculosis, or that will provide funds for the initiation of new research projects in the field.

Address applications and inquiries to: Mrs Barbara M. Hugonnet, Director, Heiser Program for Research in Leprosy and Tuberculosis, 450 East 63rd Street, New York, New York 10021, USA.

Instructions to Authors

Papers submitted for publication in *Leprosy Review* should be sent to the Editor, Professor J. L. Turk, LEPRA, Fairfax House, Causton Road, Colchester CO1 1PU, England. The name(s) of the author(s) and the place where the work was done should be clearly indicated below the title of the paper. Degrees and diplomas are not to be included.

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Leprosy Review is published quarterly (Mar., June, Sept., Dec.) by LEPRA. 1995: Volume 66, 4 issues; £30, or £7.50 per copy, inclusive of postage and packing (UK and abroad). Subscription orders or enquiries should be sent to (LEPRA), Fairfax House, Causton Road, Colchester CO1 1PU, England. At its own discretion, LEPRA will continue, and also expand, its policy of sending free issues of this journal to people in various parts of the world; this will include doctors working directly with leprosy who cannot afford the above subscription, or obtain foreign currency, together with selected libraries covering tropical medicine.

Typeset and printed at Alden Press Limited, Oxford and Northampton, Great Britain

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