Volume 67, Number 2, June 1996

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

British Leprosy Relief Association
LEPRA

Editorial Office: Lepra, Fairfax House, Causton Road, Colchester CO1 1PU, England
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Leprosy Review is published by the British Leprosy Relief Association (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.

British Leprosy Relief Association
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Editorial

DIAGNOSIS AND MANAGEMENT OF SINGLE LESIONS IN LEPROSY

Introduction

Most clinicians will probably agree that it is more difficult to ascertain the diagnosis leprosy if only one skin lesion is found (which looks like leprosy) than if the patient presents with several lesions. In other words, a high sensitivity (few false negative diagnoses) *and* a high specificity (few false positive diagnoses) are difficult to achieve in patients with only one skin lesion, and in particular, if the single lesion is on the face, where unimpaired sensation does not exclude a diagnosis of leprosy.[1] If the single lesion is an enlarged nerve many clinicians will 'for all practical purposes' decide that the diagnosis must be leprosy and that antileprosy treatment should be commenced although, even in highly endemic areas, not all nerve enlargement is due to leprosy. In Ethiopia definitive histopathological evidence of leprosy was found in only 42 out of 81 biopsies from (presumably enlarged) peripheral nerves.[2] There have also been several reports about ischiatic nerve damage following injections of quinine, which can be confused with nerve damage due to primary neuritic leprosy.[3,4]

The extent of the problem

The first question to be asked is: 'What is the size of the problem, is it worth discussing?' During a school survey in Panaji (India) the 'majority' of 26 newly-found patients had single lesions.[5] When 10,163 students were examined in the Kaniyambachi Panchanyat Union 137 leprosy cases were detected of whom 86·1% had but a single lesion.[6] On the other hand, only 15·4% of patients found during a school survey covering 21,412 students around Surat (India) had single lesions.[7] Among 172 nonlepromatous patients belonging to the Armed forces of India 59·8% had a single lesion at the time of diagnosis.[8] In South India the proportion of single-lesion leprosy detected between 1987 and 1991 in a Government Leprosy Control Unit and in the field area of a Central Leprosy Teaching and Research Institute were 56% and 61%, respectively. These proportions were higher among children (71%, 1227/1713) than among adults (48%, 1395/2893). Most of the patients were found during surveys.[9] In Malaŵi (Africa) the

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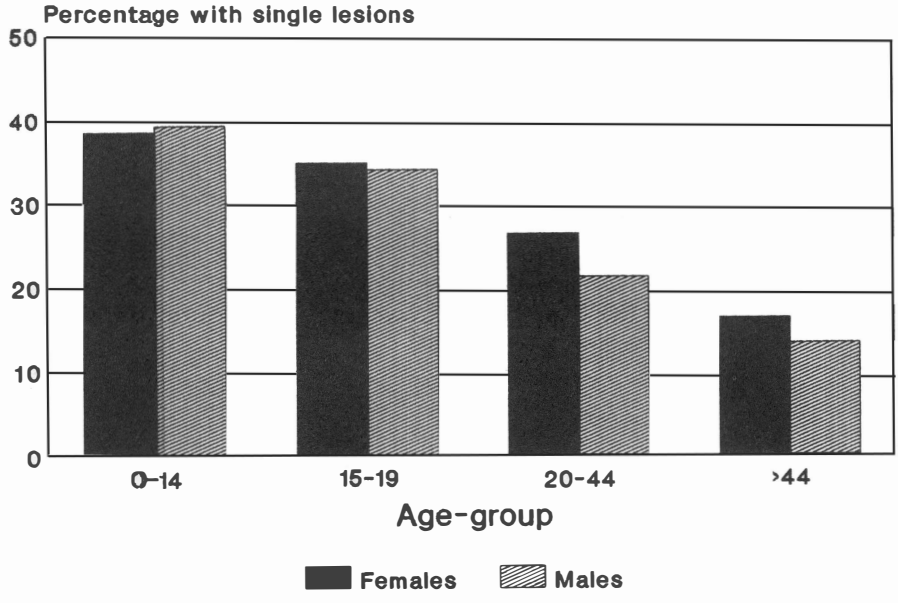

Figure 1. Percentage of new PB-leprosy patients with single (skin) lesions by age group. Malawi 1984–94.

percentage of patients with a single skin lesion varied considerably from year to year but was between 20 and 30% for most years between 1984 and 1994. The vast majority of these patients were self-reporting. There is, like in South India, a clear trend for the percentage of single lesions to decrease with age, as can be seen from Figure 1.[10] This age related trend can be interpreted in three ways: young people are examined more thoroughly or, they self-report earlier than older people or, the percentage of pauci-bacillary patients with single lesions is genuinely higher among younger than among older people.

However, on the whole the data mentioned suggest that at least a proportion of single lesion leprosy will, without treatment, progress towards multilesion leprosy. This interpretation is supported by many case histories of patients who (if asked carefully) can tell that their disease started with one lesion, and how long it took for subsequent lesions to appear. This time lag can be weeks, months or even years.

If the above interpretation is correct—and there is little reason to doubt it—it is certainly an argument to take single lesions seriously in order to prevent multilesion leprosy which is already associated with considerable nerve damage at the time of diagnosis.[9,11]

The anatomical distribution of single lesions, because they are thought to be the initial lesions, has been used to try to illuminate modes of transmission. Such studies are however only useful where patients were found during population surveys, or where no stigma at all is attached to the disease. Among self-reporting patients most lesions will be on the exposed parts of the body where they can not be hidden.[12] When comparing data from vaccine trials in Uganda and Burma (Myanmar) and from a total population survey in Karonga district (Malawi) considerable regional differences in the distribution of single lesions emerge: in Malawi and Uganda 29 to 44% of single lesions were on the

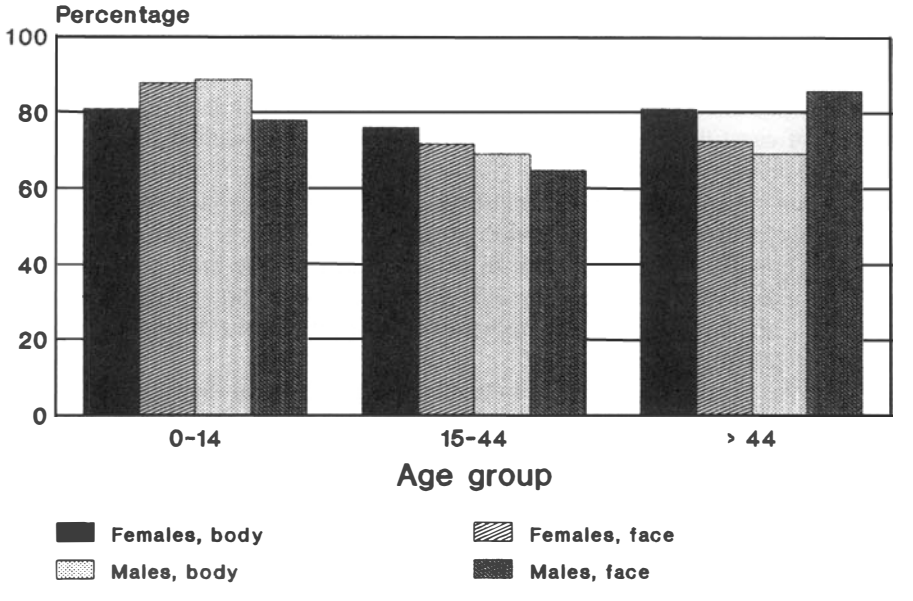

Figure 2. Percentage of suspects with single (skin) lesions in whom a definite diagnosis of leprosy could be made, Karonga district (Malaŵi) 1979–94.

face of patients under 20 years of age. In Burma the face was the site of single lesions in a mere 3%. On the other hand, in Burma 18% (86/469) of single lesions were found on the buttocks while in Malaŵi only 4% (8/182) were found in this covered area.[13] Whether these differences are really expressions of different modes of transmission remains to be seen. No doubt further data from population surveys would be useful to help in the interpretation of the findings.

Diagnostic problems

As a rule single-lesion leprosy is paucibacillary leprosy, but my own observations and several published reports suggest that occasionally multibacillary leprosy may also present itself as a single lesion.[14–16] However, on the whole the problem of classification would appear to be a minor one.

On the other hand, single-lesion leprosy can be confused with single lesions due to a number of other diseases.[17] Prominent among these in my experience are vitiligo, pityriasis alba, granuloma annulare, granuloma multiforme, actinic lichen planus,[18] pseudolymphoma, Jessner's lymphocytic infiltrate, eosinophilic granuloma, sarcoidosis, morphea, tinea and even necrobiosis lipoidica which is frequently anaesthetic.[19] Once sporotrichosis was reported to have entered the differential diagnosis.[20]

However, the question arises whether diagnostic issues are a genuine problem for leprosy control programmes or whether these single lesions are at the fringe of the main activities of programmes, namely the treatment of patients and the prevention of disabilities. There do not seem to be many published reports discussing this question. In India a senior medical officer could only confirm the diagnosis leprosy in 80% of 142

suspects detected by paramedical workers.[21] It is, however, not clear how many of these cases had single lesions, and so I have to refer to some unpublished data. These are presented in Figure 2. On the whole, about three quarters of single lesions, which were suspected by paramedical workers to be due to leprosy, were indeed due to leprosy when the results of careful clinical examinations by a medical officer and histopathological examination results were combined.[22,23] The differences between the face and the rest of body, between males and females, and between different age groups are minor, although in children the proportion of single-skin lesions which could be confirmed to be due to leprosy was consistently higher than in other groups. These data confirm that single lesions pose a considerable diagnostic difficulty after having shown that single lesions are the only sign not only in a high proportion of suspects found during surveys but also among self-reporting patients.

It would be easy to suggest that better training in general dermatology for all staff involved in the diagnosis of leprosy and the general establishment of histopathology services would solve the problem of the sensitivity and specificity of the diagnosis of single lesions. This might be the answer in isolated circumstances but it can obviously not be the general solution. Nor is it likely that polymerase chain reaction (PCR) technology, which must be more sensitive than Ziehl-Neelsen staining, will become readily available to help solve diagnostic problems in the field.[24]

The future

If there was a single dose treatment for leprosy which, at least in paucibacillary leprosy, was 100% effective, free from serious side-effects and cheap, one could envisage simply giving this treatment to all suspects with single lesions. Perhaps only a minority would benefit from this treatment, in so far as some genuine leprosy lesions might have healed by themselves without treatment, and in so far as a proportion of lesions would not be due to leprosy. But if no serious side-effects occurred this would be ethical and be similar to the situation in schistosomiasis, ascariasis and onchocerciasis, where targeted mass treatment is given without ascertaining a diagnosis in each and every treated individual.[25,26]

There is some evidence that single (paucibacillary) leprosy heals faster than multi-lesion leprosy. After 6 months of treatment with monthly rifampicin and daily dapsone (WHO/MDT) 20/33 single lesion cases but only 5/33 multilesion cases had become 'inactive' in a study in India.[27] In another study 58/72 (81%) of single-lesion leprosy cases had become inactive after 6 months of treatment but only 334/506 (66%) of multilesion cases.[28] Even more relevant to the proposal to develop a safe single-dose treatment for (suspected) single-lesion leprosy is a trial carried out in Zaire. Two single-dose regimens (rifampicin plus clofazimine versus rifampicin, clofazimine, dapsone plus ethionamide) were compared. The differences between them were negligible: for both regimens probabilities of cure in patients with 1 or 2 lesions were well above 80%.[29] On the other hand, single doses of new agents, minocycline, clarithromycin and fluoroquinones, proved not to be bactericidal in pilot trials.[30]

Nevertheless, to develop a single-dose regimen seems to be the way forward to deal with suspected single-lesion leprosy rather than to develop better diagnostic skills or more sophisticated methods of diagnosis, which are unlikely to ever reach district

hospitals and health centres. Therefore further trials with single-dose regimens are urgently required to develop one standard regimen. With such a single-dose regimen for suspected single-lesion leprosy, school surveys and contact surveys would become meaningful once more, because in many places it would not be necessary to build up a treatment network and promote health education to encourage patients to come for regular treatment. A lot of multilesion leprosy and nerve damage could no doubt be prevented with a safe and effective single-dose regimen for single-lesion leprosy.

Whether it might be useful to treat people in leprosy endemic areas who show no signs of leprosy with such a single dose, e.g. of rifampicin, ofloxacin and minocycline, is another question. A plan exists to do just that in the Federated States of Micronesia.[31] Unfortunately however, no provision seems to have been made yet for a placebo group to study the long-term effects of this intervention.

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Antisphingolipid antibodies in the sera of leprosy patients

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Accepted for publication 28 November 1995

Summary Earlier we reported the presence of significant levels of antigalactocerebroside (GalC) antibodies in the sera of leprosy patients. This study corroborates the above result and also gives evidence for the presence of antibodies to the nonpolar ceramide (Cer) moiety of GalC. AntiCer antibody titres were higher as compared to antiGalC antibodies in all categories of leprosy. The specificity of antibodies directed to the Cer moiety was confirmed using Lactosyl-BSA and neutralization assays. Statistically significant and positive correlations were observed between antiGalC and antiCer antibodies. Responsiveness factors were computed using natural logarithmic transformation of the variables.

Introduction

Peripheral nerve damage, leading to anaesthesia and muscular atrophy, is a key feature in the pathology of leprosy.[1] *Mycobacterium leprae*, the aetiological agent, selectively infects the Schwann cells of the peripheral nervous system.[2,3] Nerve damage is seen throughout the spectrum of the disease, but occurs more rapidly and with greater severity in the tuberculoid form (TT) than in lepromatous leprosy (LL). This destruction of the nerve has been attributed to metabolic/biochemical alterations in the Schwann cell[4,5] resulting from Schwann cell-*M. leprae* interaction or due to the presence of circulating demyelinating factors.[6] The occurrence of a vigorous immune response in tuberculoid nerve lesions, which contain very little mycobacterial antigen, suggests that some form of autoimmune recognition may have been induced. The demonstration of high concentrations of autoantibodies to neural protein and lipid antigens in the sera of leprosy patients[7–11] as well as in *M. leprae* infected Sooty Mangabey Monkeys[12] is consistent with the speculation that autoimmunity may have a role in neuropathy.

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0305-7518/96/067095 + 09 $1.00

Neutral glycosphingolipids (GSL), namely galactocerebrosides (GalC), gangliosides (Gg) and sulphatides (SL) which are abundant in nervous tissues, are known to be immunogenic. AntiGSL antibodies have been well recognized to have a role in some peripheral motor and sensory neuropathies.[13] Our earlier study gave evidence of circulating antibodies to total nerve lipids and GalC in the sera of leprosy patients,[11] with antiGalC antibody titres being highest in tuberculoid leprosy patients. However it was observed that there was no correlation between antiGalC antibody titre and the degree or extent of nerve damage in leprosy.[11] Such an effect suggests that possibly antiGalC antibodies present in leprosy sera lack demyelinating properties. GalC comprises of a galactose residue bound in a β–glycosidic linkage to a ceramide moiety. Here we report that unlike in other peripheral neuropathies, where the antibodies are directed to the sugar moiety of GalC, in leprosy it is predominantly directed towards the ceramide moiety (Cer). The antiGalC antibodies produced in leprosy may be trapped by GalC and Cer that are released on degradation of myelin and its constituents.

Materials and methods

SUBJECTS

Sera were obtained from a total of 192 leprosy patients attending two leprosy centres in New Delhi: 56 lepromatous leprosy (LL), 36 borderline–lepromatous (BL), 33 borderline–borderline (BB), 33 borderline–tuberculoid (BT), 24 tuberculoid (TT), and 10 neuritic (NEU) leprosy cases. Sera was also collected from 7 patients with other neuropathological disorders (NP), i.e. either Guillain-Barré syndrome, diabetic neuropathy, systemic lupus erythematosus or multiple sclerosis. Normal healthy controls (NOR, 20) were from leprosy nonendemic areas and were of varied socioeconomic groups. The sera were stored at $-20°C$ until use.

ANTIGENS

Galactocerebroside (Type I and II from bovine brain) was obtained from Sigma Chemical Co., St Louis, Mo. and ceramide was purified from human brain at the Centre for Biochemical Technology, New Delhi. Natural disaccharide-BSA (ND-BSA) and lactosyl-BSA (galactose-β-(1–4)-glucose-BSA) were provided by Dr Patrick Brennan, Colorado State University, USA.

LIPID ELISA

Human leprous sera were assayed for the presence of antibodies to GalC and Cer according to our earlier protocol.[11] The lipids (GalC 4 μg/ml; Cer 4 μg/ml) were suspended in absolute ethanol, coated (50 μl/well) on polyvinyl chloride (PVC) plates and evaporated overnight at room temperature. Nonspecific binding sites were blocked with 3% bovine serum albumin in phosphate-buffered saline (PBS, 50 mM pH 7·4) at 37°C for 1 hr. Serum samples were added at a dilution of 1 : 100 as mentioned earlier. Rabbit antihuman IgM horseradish peroxidase conjugate (Dakopatts, Copenhagen, Denmark) was added at a 1 : 1000 dilution. Substrate consisting of o-phenylene diamine and hydrogen peroxide was added as reported earlier and absorbance was read at 490 nm using microplate autoreader (EL 309 Biotek Instruments).

ELISA WITH ND-BSA AND LACTOSYL-BSA

Lactosyl-BSA at 2 μg/ml and ND-BSA at 200 ng/ml carbonate-bicarbonate buffer (0·2 M, pH 9·2) was coated on PVC plates and incubated overnight at 37°C. After blocking with 3% BSA in PBST (PBS containing 0·05% Tween 20), leprous serum was added at a dilution of 1 : 100 in 1% PBST. The rest of the protocol was as mentioned above.

NEUTRALIZATION ASSAY

Fifty microlitre aliquots of 1 : 100 dilutions of a pool of 10 antibody-positive lepromatous (LL) sera were incubated at 37°C with varying amounts of lipid antigens (GalC, Cer) suspended in PBS by sonication. After 2 hr, the mixture was centrifuged at 10,000 rpm for 3 min and the supernatant was then added to the ELISA plates coated with known amounts of GalC and Cer as mentioned earlier. The residual antibody present in the neutralized serum was estimated in the plate according to the ELISA protocol.

STATISTICAL ANALYSIS

Statistical analyses were performed to understand the underlying nature of relationship between variables. Pearsons product moment correlations (r) was calculated for the variables. Regression equations (coefficient b) were estimated to determine the responsiveness factors.

Results

The results of individual patients were expressed as the difference between mean absorbance of duplicate wells coated with antigen and the mean absorbance of duplicate wells without antigen ($\triangle$ OD). Sera giving OD readings greater than the second standard deviation (SD) above the mean OD of normal sera were considered to be positive (cut-off point = mean + 2 SD). Initial screening with sera determined that anticeramide antibody and antiGalc antibodies were primarily of IgM in nature. Antibodies directed to sulphatide were also measured but detected in only 25% of the cases and were of very low titres. Hence this antigen was excluded in the subsequent screening (data not shown). The scattergrams in Figures 1 and 2 represents the titres of antiGalC and antiCer antibodies in the sera of leprosy patients. There was a graded reactivity of both GalC and Cer to leprous sera across the spectrum, with a broad range of values. Interestingly, the mean absorbance values of antiCer antibody (0·38–0·42) were higher than the mean absorbance values of antiGalC antibodies (0·16–0·35) in all the individual subject groups. However, antiCer antibody titres were higher than that observed in normal and other neuropathies in 82% LL, 75% BL, 60% BB, 81% BT, 66% TT and 80% neuritic cases. No correlation was observed between both the antibody levels and extent of lesions, presence or absence of neuritis and deformities. Antibodies to GalC and Cer were absent in normal (NOR) individuals and in patients with other neuropathological disorders (NP).

Two statistical techniques were employed to examine the relationship between

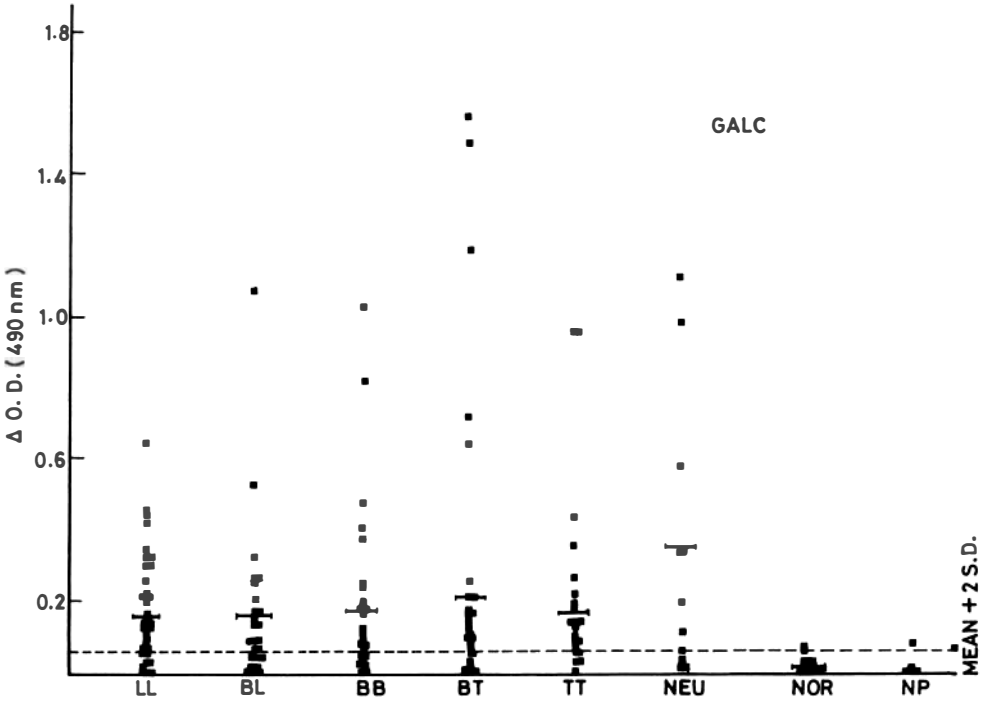

Figure 1. Serum levels of antiGalC antibodies in leprosy patients. Horizontal bar indicates mean value. Mean + 2 SD = 0·065.

antiGalC and antiCer antibodies for different classes of leprosy. Pearson's product moment correlation (r) and regression analysis were performed for these two antibodies (Figure 3). The correlation coefficients for antiGalC and antiCer antibodies show that they are positively correlated and highly significant for all categories of leprosy, as well as for normals. The value of r^2 is highest in the case of normals with a value of 0·97. In the case of neuritic (NEU) r is calculated to be 0·90. For BT, TT and BB the correlations are fairly high with values of 0·76, 0·75 and 0·73, respectively. In contrast the least correlation was found for those classified as BL and LL: $r = 0{\cdot}43$ and 0·44. But the correlation coefficients do not measure the extent of variation in antiCer that is attributable to antiGalC. For understanding this, a regression analysis using natural logarithmic (ln) transformation of the variables was performed. The results show that normals have the highest regression coefficient (b) with a value of 1·11. The b values of BB and BT are close to 0·70, whereas of BL, LL, BT and Neu are between 0·21 and 0·34 which are all statistically significant.

The reactive group of GalC was delineated by using Cer, ND-BSA and Lactosyl-BSA as individual antigens and tested against sera of leprosy patients. High titre antibodies to ND-BSA was observed throughout the spectrum of the disease (Figure 4). However, the antibody titre to lactosyl-BSA was negligible in all the leprosy patients (Figure 5). This indicates that the antibodies react with the terminal sugar moiety of ND-BSA but do not react with the terminal galactose moiety of lactosyl-BSA. Presence of antibodies to Cer antigen is shown in Figure 2.

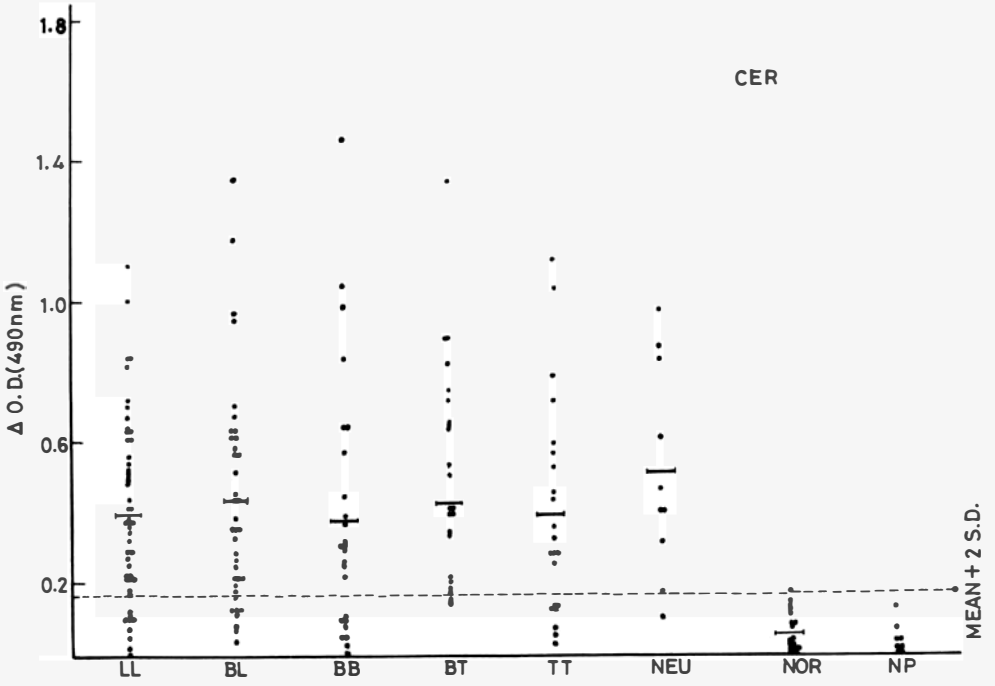

Figure 2. Serum levels of antiCer antibodies in leprosy patients. Horizontal bar indicates mean value. Mean + 2 SD = 0·17.

The cross-reactivity between GalC and Cer was assessed by neutralization assay (Figure 6). Pooled LL sera was adsorbed with varying concentrations of Cer and reactivity was checked against GalC (Figure 6(a)). There was a decline in the level of residual antiGalC antibodies. Similarly, adsorption of LL sera with varying concentrations of GalC and titrated against Cer showed a decline in the level of residual antiCer antibodies (Figure 6(b)).

Discussion

Circulating demyelinating factors are currently being implicated as mediating leprous neuritis; the precise mechanism by which this occurs remains unknown. Microbial antigens cross-reacting with nerve constituents in a susceptible host has been found to result in an idiosyncratic immune response. The humoral response is at least in part directed to lipid antigens. The importance of lipids in autoimmune responses has been suggested in many studies. Gangliosides, phospholipids and cerebrosides have been shown to potentiate the immune response and contribute to the development of experimental allergic encephalomyelitis.[14] Antibodies to these glycoconjugates have been implicated to have a role in neuropathies with a possible correlation existing between specific target antigens and clinical symptoms. Of these, antiGalC antibodies have been shown to cause complement dependent demyelination both *in vivo* and *in vitro*.[15,16]

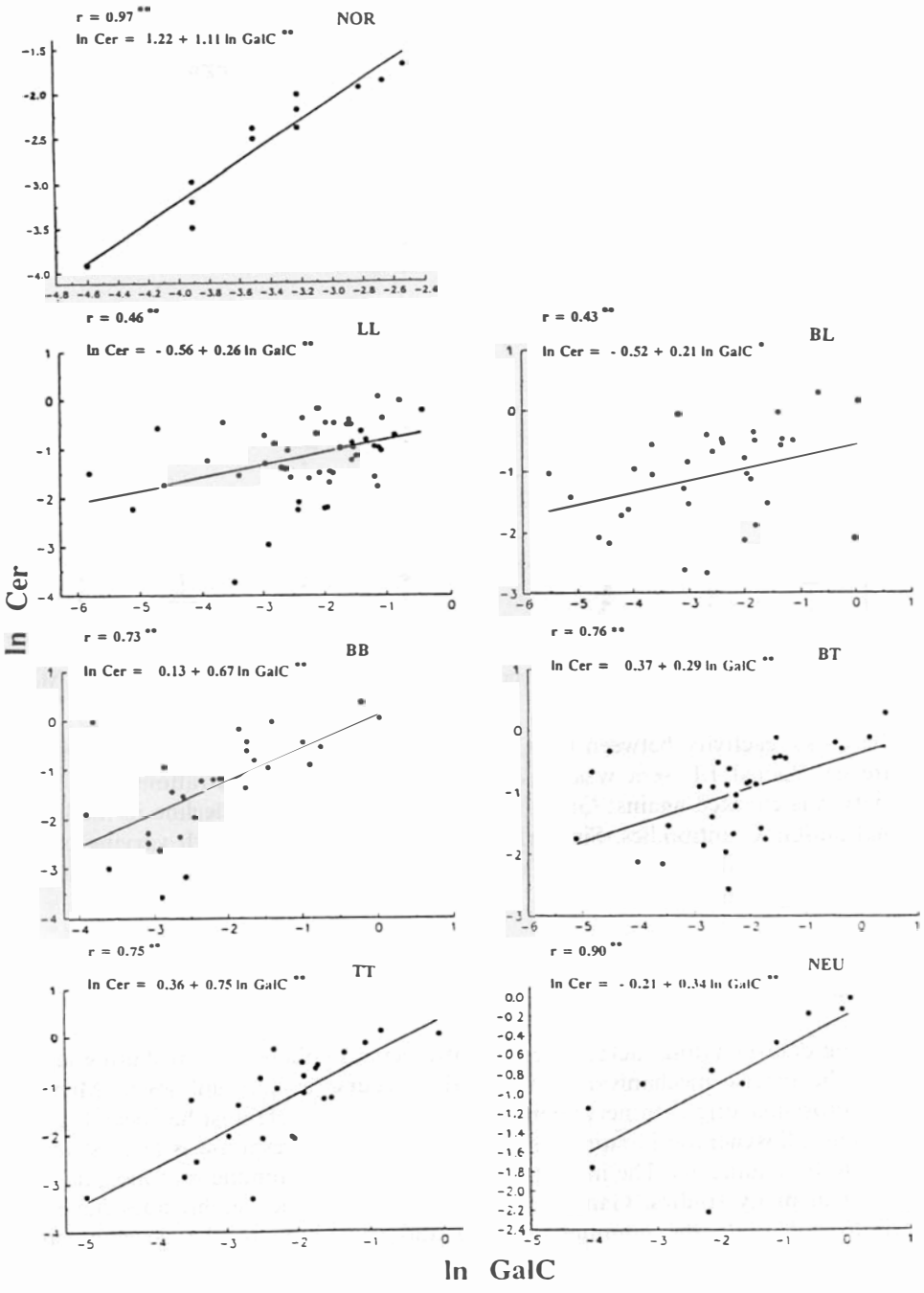

Figure 3. Correlation and Regression Analysis between ln antiCer and ln antiGalC antibodies. ln, natural logarithms; *, $p < 0{\cdot}05$; **, $p < 0{\cdot}01$.

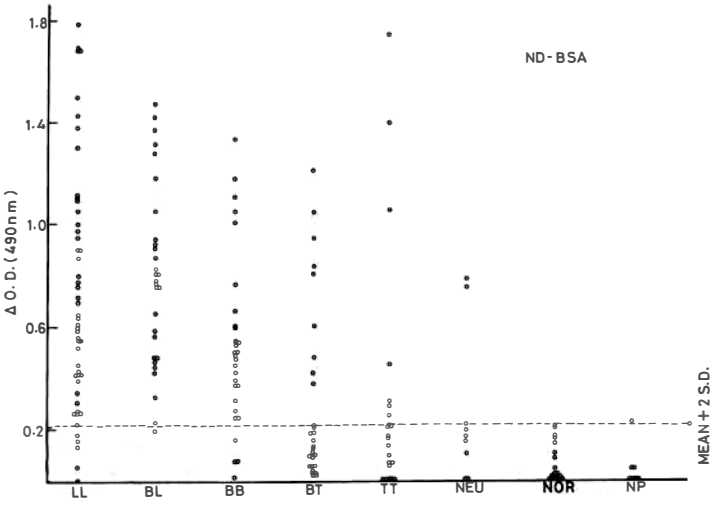

Figure 4. Serum levels of antiND-BSA antibodies in leprosy patients. Mean + 2 SD = 0·21.

Glycosphingolipids are abundant in nervous tissues and accessible to antibodies from the blood.[13] In the present study, we investigated immunoserologic responses to GSL antigens in leprosy patients and reanalysed their specificities in an attempt to clarify the clinical significance of these antibodies. Antibodies to GalC and Cer were found in sera of all categories of leprosy patients. However, antiCer antibody titres were higher as compared to antiGalC titres. On the basis of the above profiles, the reactivities of antiGalC and antiCer antibodies were correlated. A highly significant and positive correlation was observed between the two antibodies in all categories of leprosy patients. As mentioned above, the correlation between the two antibodies decreased towards the lepromatous end of the pole while at the tuberculoid end they were moderately correlated. The above correlation analysis, however does not explain the extent of variation in antiCer that can be associated with variation in antiGalC. This variation is indicated by the regression coefficients (*b*), the values of which are given above. The regression coefficient values for TT and BB are 1·20 and 1·4, respectively. Changes in Cer that are attributed to GalC are estimated in terms of 'responsiveness factors'. These

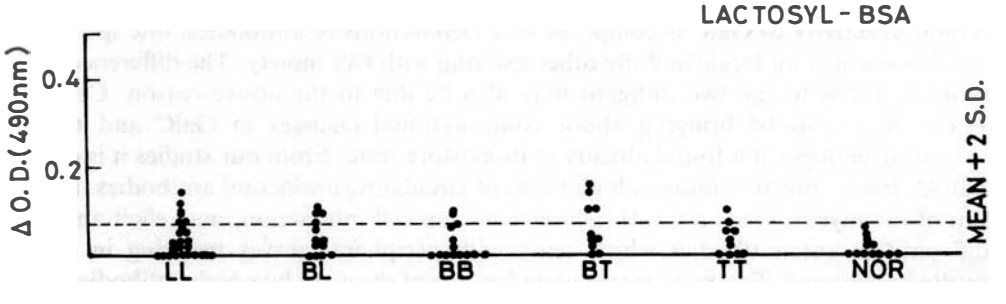

Figure 5. Serum levels of antilactosyl-BSA antibodies in leprosy patients. Mean + 2 SD = 0·07.

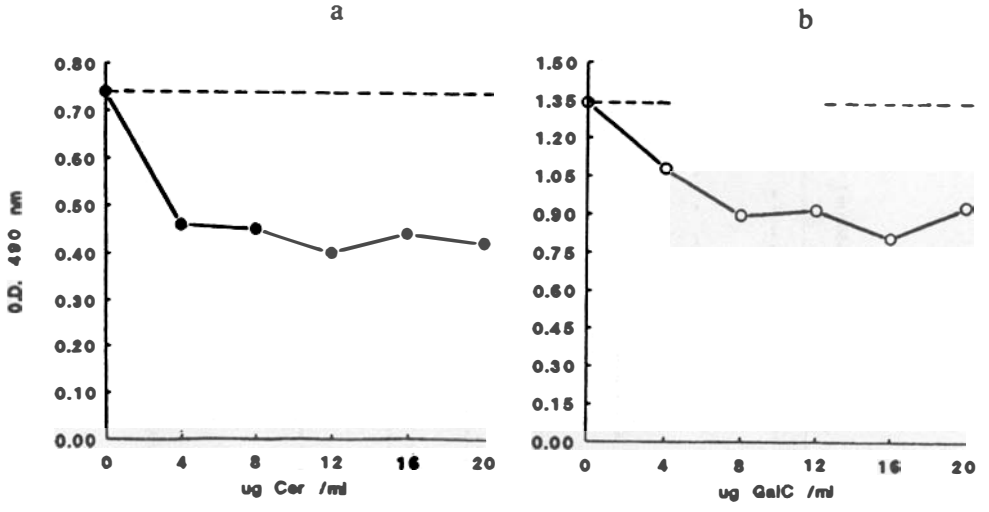

Figure 6. Neutralization assay, (a) Adsorption of LL sera with Cer: reactivity against GalC. (b) Adsorption of LL sera with GalC: reactivity against Cer Dotted line indicates unadsorbed LL sera.

factors, given by the '*b*' values, indicate the percentage change in Cer due to a percentage change in GalC. The responsiveness factors may seem to be anomalous when compared with '*r*'. But when the results of the statistical techniques are examined together, it is clear that while LL patients show smaller correlations between Cer and GalC, in the case of TT there is greater responsiveness of GalC on Cer. It is interesting to study such a change in antiCer due to antiGalC since there is evidence that antiGalC antibodies may be involved in oligodendrocyte loss and myelin destruction.[17] The importance of assessing the role of antiGalC and antiCer antibodies in the nerve damage process in leprosy assumes significance since antiGalC antibodies have been experimentally shown to inhibit the myelination process or cause demyelination *in vivo*[15–20] and *in vitro*.[21] Ceramide has also been shown to function as an intracellular mediator of apoptosis.[22] From the neutralization assay studies we can speculate that antiGalC antibodies as well as antiCer antibodies can bind to circulating Cer antigen and thereby inhibit the presence, if any, of Cer induced apoptosis. The absence of antibodies to lactosyl-BSA in leprous sera confirms the specificity of antibodies reacting with the ceramide moiety of GalC. This is one of the first reports whereby antibodies to the nonpolar residue have shown good reactivity and be present in high titres. The possibility also exists that immunoreactivity to GalC is composed of 2 populations of antibodies; one specific for GalC as a whole molecule and the other reacting with Cer moiety. The difference in the antibody levels to the two antigens may also be due to the above reason. Ceramide residue may also be bringing about confirmational changes in GalC and thereby presenting epitopes not found already in its existing state. From our studies it is evident that *M. leprae* infection induces high levels of circulating antineural antibodies. Liberation of the myelin lipids after *M. leprae*-Schwann cell interaction, may elicit antiGalC and antiCer autoantibodies which react with peripheral nerves resulting in further myelin breakdown. This may be speculated as one of the ways by which antibodies could cause nerve damage in leprosy.

Acknowledgments

This study was supported in part by funds from Council of Scientific and Industrial Research, New Delhi, India. L. M. Viera was a recipient of a WHO fellowship. We gratefully acknowledge the statistical analysis by Dr P. V. S. Kumar, National Institute for Science Technology and Development Studies, New Delhi.

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Nerve function impairment in leprosy: an epidemiological and clinical study – Part 2: Results of steroid treatment

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Accepted for publication 28 November 1995

Summary This restrospective cohort study aimed to determine the progress of sensory and motor function during and after steroid treatment, and to identify any prognostic factors for the outcome of treatment.

The study used one hundred and sixty-eight leprosy patients registered at Green Pastures Hospital, Pokhara, West Nepal, who were treated with one of four different corticosteroid regimens for impairment of nerve function.

The function of the main peripheral nerve trunks affected in leprosy was assessed with a nylon filament to test touch thresholds (TST) and a manual voluntary muscle test (VMT) to quantify muscle strength. The TST and VMT scores at 3 months after initiation of steroid treatment served as the main outcome measure. The significance of potential prognostic factors was evaluated with logistic regression.

At 3 months, the sensory and motor function of the majority of patients with 'recent' impairment (= less than 6 months duration) had improved significantly ($p < 0{\cdot}01$, Wilcoxon matched pairs signed-ranks test). The likelihood of 'good' recovery (prognosis) for both sensibility and motor function was directly related to the severity of the nerve damage at the beginning of treatment.

Although nerve function improved in 30–84% (depending on the type of nerve) of patients, an active search for better methods of treatment and improved regimens is justified. The need for early assessment and treatment is stressed.

Introduction

The most important method of preventing disabilities in leprosy patients is the *early* detection and *adequate* treatment of neural impairment.[1] The benefits of steroid treatment of leprosy reactions and leprous neuropathy have been recognized for several decades.[2] Its use appears to be safe as, fortunately very few serious side-effects have been reported thus far.[3,4] To date there is no consensus about the regimen or type of

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0305-7518/96/067104+15 $1.00

corticosteroids that should be used. To our knowledge no randomized controlled trials have been conducted to determine an optimal regimen. No data have been published comparing nerve function at the beginning and completion of antileprosy treatment. The studies that have given details of the outcome of (anti-)neuritis treatment have mainly used motor function as a parameter for assessment.[5,6] This is surprising since the value of sensibility testing using graded nylon monofilaments, especially for detecting mild (early?) nerve function impairment (NFI), has already been reported in 1977 by Naafs.[7] The importance of sensibility testing was again stressed by Brandsma in 1981,[8] by Pearson, reporting on an international workshop on nerve damage, in 1982,[9] and recently by Palande & Bowden.[10]

This lack of reference data prompted us to conduct the present study. It was carried out at Green Pastures Hospital (GPH), a 100-bed leprosy referral hospital in Pokhara, West Nepal, run by the International Nepal Fellowship. Good, standardized record-keeping and nerve function assessment (NFA) protocols allowed retrospective analysis of a 4-year patient cohort (1988–92). The aims were: 1, to determine the progress of sensory and motor function during and after antineuritis treatment, analysing results with respect to the duration of impairment, type of nerve, different treatment regimens, the Ridley–Jopling classification of leprosy and extent of clinical disease; and 2, to identify any prognostic factors for the outcome of treatment.

Methods

CRITERIA FOR INCLUSION AND EXCLUSION OF PATIENTS

Between January 1988 and January 1992 all newly-registered patients with impaired nerve function, all treated patients who developed clinically detected neural impairment, and all patients who were referred to GPH for treatment of neuropathy were included in the study. Patients whose steroid treatment was started elsewhere more than one week before arrival at GPH were excluded.

PATIENTS AND STUDY DESIGN

A retrospective analysis was carried out of a 4-year-patient cohort (1988–92). Two hundred and eighty-seven patients had neural impairment and of these 168 were treated with corticosteroids, and are the subject of the present study. Since this was a retrospective analysis several of the patients admitted in GPH were lost to follow-up because they were referred elsewhere after discharge from the hospital. Nevertheless, all patients who were started on treatment were included in the analysis, whether or not they were lost to follow-up. Furthermore, we compared the 3-month results for patients who had no 6-month follow-up with the 3-month results of those who did, to examine whether any systematic differences existed.[11] The 'lost to follow-up group' was *not* significantly different from the remaining patients in sex, age, improvement of overall TST and VMT scores at 3 months, or extent of clinical disease. Only the proportion of patients treated with dexamethason was higher in the 'lost to follow-up group'. We chose to use the 3-month results as the main end point for analysis, because the losses to follow-up were still within acceptable limits at that time (12% *vs*

39% at 6 months). In addition, most of the observed improvement in neural function occurred within the first 3 months.

DIAGNOSIS AND CLASSIFICATION

Methods of diagnosis and classification, using the Ridley–Jopling classification, as well as our 'body area classification system', laboratory examinations and histology have been described in detail in a previous paper.[12] Briefly, the body area system is based on a count of the number of areas out of a total of 9 that show primary or secondary signs of leprosy (head, 4 extremities, front and back, both divided into left and right side). These may include skin lesions, enlarged nerves, clawing of fingers and other paralytic deformities, and ulcers. A patient with three or more affected body areas is referred to as having 'extensive disease' (multibacillary, MB). All others are classified as having 'limited disease' (paucibacillary, PB). The Ridley–Jopling classification was usually based on clinical criteria (*including skin smears*) as outlined by Jopling.[13] In about 30% of the patients it was supported by a skin biopsy.

DEFINITION OF NERVE FUNCTION IMPAIRMENT (NFI)

NFI refers to impairment of function of large, peripheral nerve trunks. A patient was considered to have neurological impairment if there was a deterioration of more than 2 points in his voluntary muscle test (VMT) score, or 2 points or more in his touch sensibility test (TST) score compared to the previous result. Impairment of less than six months duration was classified as 'recent', if of longer duration, it was classified as 'old'. If no previous VMT and TST results were available, a patient was considered to have motor impairment if his VMT score was down by more than 2 points compared to the maximum score and, similarly, sensory impairment if his TST score was down by 2 points or more. In this case the patient's history was used to decide whether the impairment was 'recent' or 'old'.

NERVE FUNCTION ASSESSMENT

Nerve function was tested by one of two trained physiotechnicians at first examination, at every visit to the out-patient department, at annual examinations during and after termination of treatment, and 2-weekly for patients receiving treatment for a reaction or NFI.

VOLUNTARY MUSCLE TEST (VMT)

A full VMT was performed using the modified MRC scale as described by Brandsma.[8] The VMT score consisted of the sum of individual muscle scores (0–5; 0, paralysed; 5, normal strength). Details of the muscles tested can be found in the Appendix.

TOUCH SENSIBILITY TEST (TST)

Touch sensibility thresholds of skin areas on the hand supplied by the ulnar and median

nerves were tested using a nylon monofilament giving a force of approximately 10 g when pressed until it bent. The result was recorded as 'felt' or 'not felt' for each of the sites mentioned below. If the patient sometimes felt the touch and sometimes not, the result was recorded as 'partial'. When necessary the test was repeated until the examiner was confident about the patient's response. Sensibility on the sole of the foot was tested in a similar way using a thicker monofilament, giving a force of about 75 g. The TST score consisted of the sum of scores given for individual sites (2, monofilament felt; 1, doubtful; 0, monofilament not felt). The test sites are given in the Appendix.

TREATMENT

Only patients with recent NFI (see above), and who had no other concurrent severe illness, such as untreated tuberculosis, were considered eligible for systemic steroid treatment. The following corticosteroid regimens were used consecutively during the study period:

Dexamethasone 6 milligrams (mg) daily single dose (od) initially, tapering approximately 1 tablet (0·5 mg) every 2 weeks, depending on the progress of the patient, thus giving a duration of treatment of about 6 months ($N = 49$).

Prednisolone 30 mg twice daily (bd) initially, tapering as under '1' (1 tablet = 5 mg), ($N = 45$).

Prednisolone 60 mg once daily (od) initially, tapering as under '1' ($N = 40$).

Prednisolone 40 mg od, tapering 5 mg every 2 weeks, depending on the progress of the patient, duration about 4 months ($N = 34$).

STATISTICAL CONSIDERATIONS AND METHODS

We chose to analyse the results using patients rather than nerves as denominators, because patients were being treated and not individual nerves. Most patients had more than one nerve affected and thus the nerves of one patient were not (statistically) independent of each other. All calculations below are therefore based on one nerve per patient. For example, if a patient had both ulnar and median impairment, he would appear once in the ulnar nerve analysis and again in the median nerve-only analysis. The same patient was, therefore, never counted twice in any given numerator or denominator. If a patient had both left and right nerves of one type affected, only the data of the most severely and most recently affected nerve were analysed.

To examine trends the VMT and TST scores were categorized into 'good', 'moderate', 'bad' and 'absent' as shown in Table 1. Similar classifications for motor function were used by Srinivasan and Kiran.[5,14] The cutoff scores for the categories were arbitrarily chosen. The change in VMT and TST score observed at 3 months after the beginning of treatment was calculated. 'Improved' was defined as a difference in TST or VMT score of more than one point on the scale; a difference of between -1 and 1 was called 'same', while a deterioration of more than -1 was called 'worse'. We used non-parametric methods, because the measurement scales were ordinal (no equal intervals between points on the scale) and because the scores were often not normally distributed. The median value of the scores at each time point was computed and the

Table 1. Nerve function classification for each of the nerves in the study

Sensory categories	Ulnar (3 sites*)	Median (4 sites)	Post. tibial (10 sites)	Radial	Lateral popliteal	Facial†
Anaesthetic	0–2	0–2	0–2			
Bad	3	3–4	3–10			
Moderate	4	5–6	11–17			
Good	5–6	7–8	18–20			
Motor categories	(2 muscles)	(2 muscles)		(2 muscles)	(2 muscles)	(1 muscle)
Paralysed	0–1	0–1		0–1	0–1	0–1
Bad	2–4	2–4		2–4	2–4	2
Moderate	5–7	5–7		5–7	5–7	3
Good	8–10	8–10		8-10	8–10	4-5

* maximum score per site: 2. † The facial nerve data in Table 4 are presented uncoded, because only 1 muscle was tested on a 0–5 scale.

Wilcoxon matched-pairs signed-ranks test[15] was used to compare paired data. The Mann-Whitney U test[15] and Kruskal-Wallis one-way analysis of variance[16] were used for independent group comparisons. The difference between proportions was tested using the Standard Normal Deviate (SND) for unpaired sample proportions.[15] The significance of possible prognostic factors was evaluated with logistic regression,[17] using the proportion of patients with a 'good' result at 3 months as outcome measure. A *p*-value of less than 5% was used as the level of statistical significance. Where appropriate the 95% confidence interval is given. Analysis was done, using Epi Info software, version 5·01[18] and SPSS for Windows, version 6·0.

Table 2. Improvement* of sensory and motor scores in 150 patients divided in 'nerve groups', 3 months after initiation of steroid treatment

TST†	Improved* (95%CI)	Same (%)	Worse (%)
Ulnar (n = 66)	60(48–71)	34(23–46)	6(0·3–12)
Median (n = 42)	84(73–95)	16(5·2–27)	
Posterior tibial (n = 57)	72(56–78)	14(5·3–22)	14(5·3–22)
VMT‡			
Facial (n = 48)	29(16–42)	71(58–84)	
Ulnar (n = 85)	47(36–57)	49(39–60)	4(0–7·5)
Median (n = 21)	76(58–94)	19(2·3–36)	5(0–14)
Lateral popliteal (n = 34)	73(59–88)	24(9·3–38)	3(0–8·6)

*proportion of patients improved with 95% confidence interval, 'Improved' = increase in VMT/TST score of > 1 point, 'same' = change in score between −1 and 1, and 'worse' = deterioration of more than 1 point on the VMT/TST scale. †touch sensibility test (using 1 nylon monofilament), ‡voluntary muscle test.

Results

PATIENTS

A total of 168 patients with sensory and/or motor impairment were included in the analysis. They were classified as follows: BT 55, BB 5, BL 67, LL 34, pure neuritic (PN) 7. The mean age was 40 years (range 11–70); 130/168 were male. One hundred and forty-seven patients received or had been released from WHO multidrug therapy (MDT), 20 were on dapsone monotherapy and 1 patient on clofazimine monotherapy. Of these 168 patients, 104 had sensory and 125 motor impairment at the beginning of treatment (the numbers do not add up to 168, because many patients had both types of impairment).

SENSORY NERVES

Table 2 shows for each nerve the proportion of patients who improved, stayed the same or got worse. Eighteen patients had been lost to follow-up, therefore only data on 150 patients are shown in Table 2. A significantly larger proportion of patients with median nerve lesions improved compared to those with impairment of the ulnar nerve ($p = 0{\cdot}008$, SND test). Results of treatment of the different sensory nerves are shown in Table 3. The sensory scores of the majority of patients with lesions of the ulnar, median and posterior tibial nerves improved until 3 months after the beginning of steroid treatment ($p < 0{\cdot}001$, Wilcoxon's test).

MOTOR NERVES

The progress of the motor scores shown in Table 4 was significant for each nerve group. Improvement in the facial and ulnar nerves was remarkably less than in the median and lateral popliteal nerves (Table 2, $p = 0{\cdot}017$, SND test). The motor function of the ulnar and lateral popliteal nerves stopped improving after 3 months, while that of the facial and median nerves continued to improve up to 6 months after starting steroid treatment. The possibility of improvement beyond the period of the study cannot be excluded.

TIME TRENDS

Figures 1 and 2 show the trend of sensory and motor nerve scores over time. Only data of patients who had impairment before the start of steroid treatment are shown (104 patients with sensory deficits, and 125 with motor lesions). The rate of improvement in both sensibility and motor function slowed down after 3 months. In both, the only changes after 3 months were between the 'moderate' and 'good' group, while the proportions 'bad' and 'anaesthetic/paralysed' remained the same. Figures 3 and 4 illustrate the proportion of patients whose sensory and motor nerves either improved, stayed the same or deteriorated during a period of 6 months after initiation of steroid treatment. The most rapid improvement occurred during the first month of steroid treatment. This was most pronounced in patients with sensory impairment. Most of the improvement in the first month occurred already during the first 2 weeks (35/37 patients who improved, data not shown). The proportion of patients whose sensory function had improved at 3 months was larger than the proportion with motor improvement (67 *vs* 50%). Nevertheless, the proportion with good function at 3 months was not very

Table 3. Change in sensory scores over time (before treatment, at 1, 3 and 6 months) in leprosy patients treated for neural impairment with corticosteroids.

	Time interval from the start of steroid treatment							
Ulnar	start ($n = 168$)	%	1m* ($n = 160$)	%	3 m ($n = 150$)	%	6 m ($n = 110$)	%
Anaesthetic	61†	86	48	70	28	42	17	39
Bad	1	1			1	2		
Moderate	9	13	9	13	10	15	4	9
Good			12	17	27	41	23	52
Total	71	100	69	100	66	100	44	100
median score‡	0		0		4		6	
Median								
Anaesthetic	22	48	18	39	5	12	3	11
Bad	14	30	6	13	8	19	3	11
Moderate	10	22	11	24	8	19	7	25
Good			11	24	21	50	15	53
Total	46	100	46	100	42	100	28	100
median score	4		4		7		8	
Posterior tibial								
Anaesthetic	23	36	21	35	12	21	7	19
Bad	18	29	19	32	14	25	7	19
Moderate	22	35	11	18	11	19	11	30
Good			9	15	20	35	12	32
Total	63	100	60	100	57	100	37	100
median score	7		8		14		14	

* month(s), † the number in each cell refers to the number of patients in that category; patients with a normal (good) sensory function at the start of treatment have been omitted. ‡ median value of the sensory test scores of the nerves with functional impairment at each point in time.

different (42 *vs* 36%), because initial impairment was much more severe in the sensory group. After the third month there was very little further improvement.

PROGNOSTIC FACTORS

No significant influence on the treatment outcome could be demonstrated for age, antileprosy treatment, bacteriological index, number of lesions or number of body areas, or reported time-lapse between onset and treatment of the nerve damage. Male sex seemed to significantly increase the likelihood of good motor recovery (adjusted odds ratio 7·3 (2·0–26), $p = 0{\cdot}017$). The level of impairment at the onset of steroid treatment has a significant influence on the outcome as is shown in Table 5. Only 35% of patients with complete anaesthesia and 11% with complete motor paralysis improved to good function at 3 months, compared to 67% and 55% for patients with moderate impairment. The difference is significant ($p < 0{\cdot}01$, SND test).

Discussion

The most important outcome of treatment for the individual leprosy patient is whether

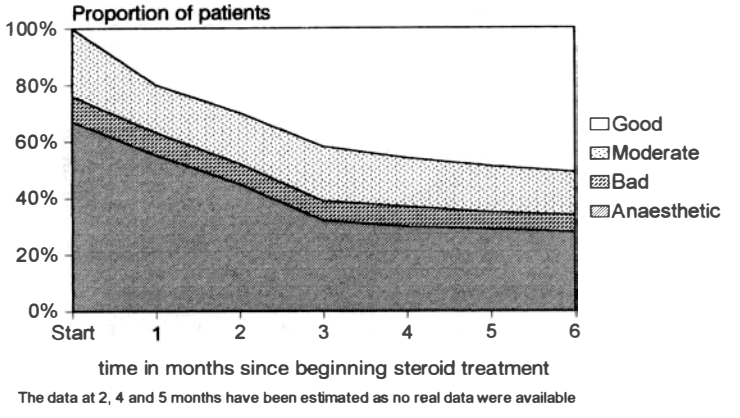

Figure 1. Proportion of patients with different levels of sensory impairment during steroid treatment ($n = 104$ at the beginning of treatment).

he will have residual disabilities, handicaps and/or deformities. Most disabilities and deformities result from impairment of peripheral nerve function (NFI). Thus, early detection and treatment of such impairment are very important.

Due to the retrospective nature of this study, a considerable proportion of patients (39%) had been lost to follow-up at 6 months after initiation of treatment. This could have seriously biased our results, if those patients discharged early had made a better recovery than the remaining ones. Comparing the 3-month results of patients who had been discharged early with the 3-month results of those reviewed at 6 months, showed no significant differences between the two groups. However, to be on the safe side, we used the results at 3 months as our main assessment of treatment.

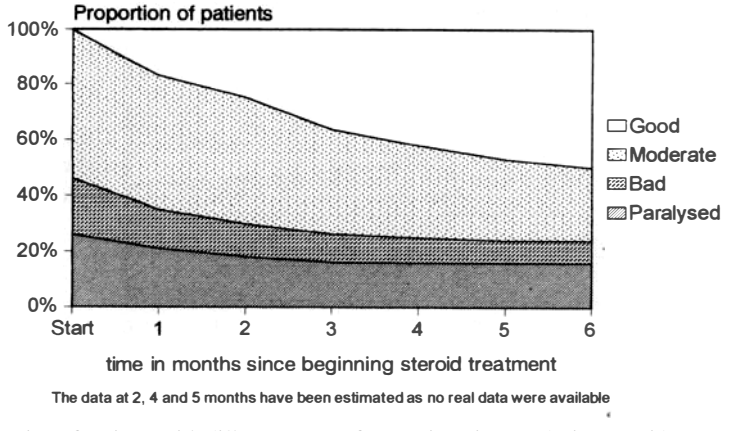

Figure 2. Proportion of patients with different levels of motor impairment during steroid treatment ($n = 125$ at the beginning of treatment).

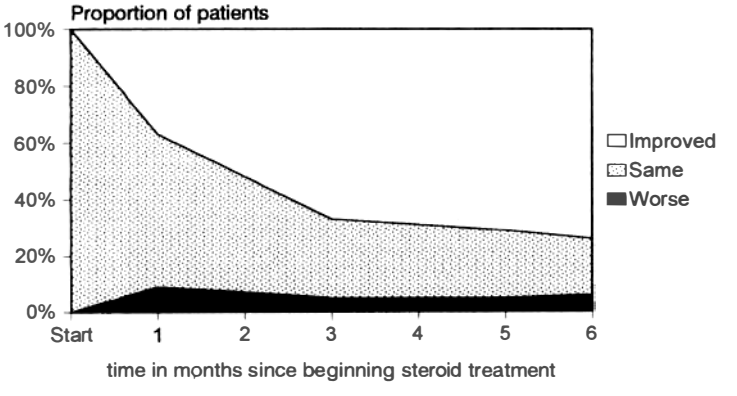

Figure 3. Progress of sensory function in leprosy patients during steroid treatment ($n = 104$ at the beginning of treatment).

CRUDENESS OF NERVE FUNCTION ASSESSMENT

The voluntary muscle test (VMT) used in our hospital is the one recommended by Brandsma.[8] Although this test is widely used, it may not be sensitive enough to pick up mild impairment.[7]

Our standardized touch sensibility test (TST) was very crude. We used a monofilament of approximately 10 g force for the hand and one of 75 g force for the foot sole. Recently, normal threshold forces in healthy Nepali subjects were found to be 70–200 mg for the hand and 2 g for the sole of the foot.[19] This means that our test consistently underestimated the extent of sensory impairment, but that, if impairment was detected, the sensibility of that particular patient was definitely impaired. In other words, our sensibility test had low sensitivity, but high specificity. The low sensitivity should not affect serial comparisons, as it was consistent throughout the study period.

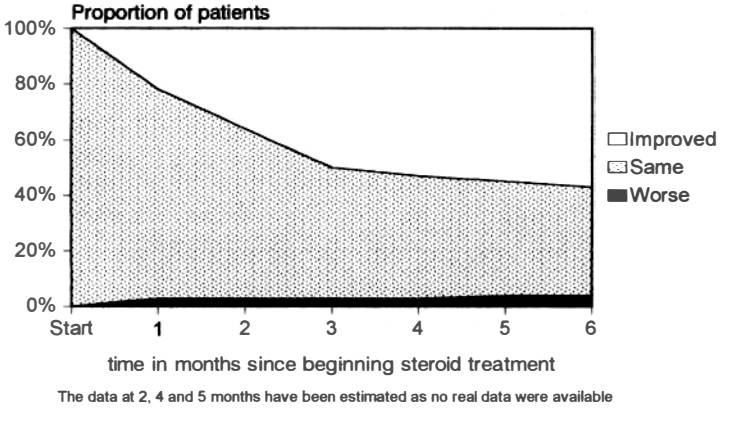

Figure 4. Progress of motor function in leprosy patients during steroid treatment ($n = 125$ at the beginning of treatment).

Table 4. Change in motor function scores over time (before treatment, at 1, 3 and 6 months) in leprosy patients treated for neural impairment with corticosteroids.

	Time interval from the start of steroid treatment							
Ulnar	start ($n = 168$)	%	1m* ($n = 160$)	%	3 m ($n = 150$)	%	6 m ($n = 110$)	%
Paralysed	19†	20	17	19	13	15	11	18
Bad	23	24	13	14	8	9	3	5
Moderate	54	56	46	50	33	39	18	30
Good			16	17	31	37	28	47
Total	96	100	92	100	85	100	60	100
median score‡	5		6		7		7	
Median								
Paralysed	5	20	5	39	4	19	3	20
Bad	4	15	3	12	1	5	3	20
Moderate	17	65	11	44	1	5	1	7
Good			6	24	15	71	8	53
Total	26	100	25	100	21	100	15	100
median score	6		6		8		9	
Lateral popliteal								
Paralysed	8	21	4	11	2	6		
Bad	4	10	4	11	3	9	3	13
Moderate	27	69	19	51	12	35	5	22
Good			10	27	17	50	15	65
Total	39	100	37	100	34	100	23	100
median score	5		7		8		8	
Facial								
0	19	34	15	28	5	10		
1	3	5			7	15	3	9
2	7	13	12	22	6	12	7	22
3	27	48	21	39	16	33	6	19
4			6	11	7	15	8	25
5					7	15	8	25
Total	56	100	54	100	48	100	32	100
median score	2		3		3		4	

* month(s), † the number in each cell refers to the number of patients in that category; patients with a normal motor function in a given nerve have been omitted, ‡ median value of the VMT scores at each point in time.

TIMING OF TREATMENT

It is generally believed that corticosteroid treatment is effective in cases with neural impairment 'of recent onset.' Usually an arbitrary time limit of 6 months duration is chosen as a definition of 'recent onset'.[3,5] Common sense would argue that NFI treated 'early' should respond better to treatment than when treated 'late', but very little evidence for this could be found in the literature. Srinivasan *et al.* reported that in a sample of 25 patients with 'quiet nerve paralysis' 83% of nerves with paralysis of 1–13 weeks duration recovered 'satisfactorily' (= VMT score of 3+ or more on the MRC scale). Only 53% of nerves with paralysis of 'longer duration' improved satisfactorily.[14] Job has shown that, particularly in lepromatous patients, peripheral nerves may already show evidence of advanced neuropathy before they are 'clinically affected'[20]. McLeod *et al.*,

Table 5. Association between the level of impairment at the onset of treatment and after 3 months in patients with sensory and motor deficits.

Start*		Sensibility at 3 months						
		Absent	Bad	Moderate	Good	%†	Lost‡	Total
Absent		29	3	9	22	35	7	70
Bad			3	4	2	22		9
Moderate		2	1	5	16	67	1	25
	Total	31	7	18	40	42		104
				Motor function at 3 months				
Absent		12	5	8	3	11	4	32
Bad		5	4	9	4	18	3	25
Moderate		1	2	24	33	55	8	68
	Total	18	11	41	40	36		125

* Score category at the start of steroid treatment (See Table 1), † proportion of nerves scoring 'good' after 3 months among the total number in the row category (start of treatment), ‡ the number of patients in each category that was lost to follow-up at 3 months.

using nerve conduction studies, found signs of impairment of function in over half of 'clinically unaffected' nerves.[21] This suggests that it may be possible to detect impairment earlier if more sensitive instruments were used. Studies are needed to investigate whether nerve lesions detected early respond better to treatment than those detected with current high threshold stimuli.

In the current study, there was a weak association between the reported duration of NFI and the results of treatment for patients with sensory impairment, but this association was no longer apparent after adjusting for age in multivariate analysis. The expected association may have been lacking because the information about duration of impairment was often based on the patient's history, which is not always very accurate concerning time related information.

INDIVIDUAL NERVES

A striking difference was observed in the response of the ulnar and median nerves. After 3 months 84% of patients with sensory and 76% of those with motor impairment of the median nerve had improved, whilst only 60% and 47%, respectively, of patients with ulnar nerve lesions showed improvement. The difference for the sensory nerves can be (partly) explained by the much higher proportion of patients in the ulnar group with complete anaesthesia at the start of treatment (Table 3). The motor difference cannot be readily explained in this way. The fact that the ulnar motor function recovered less than that of other motor nerves averaged together, was described by Srinivasan *et al.*[14] Improvement of a larger proportion of affected median motor nerves compared to ulnar motor nerves was also described by Touw *et al.*,[6] Kiran *et al.*[5] and Becx & Berhe.[3] The latter study reported on 161 patients treated with prednisolone in the field. Nerve function was assessed directly after stopping steroids, using a 3-point-scale 'field VMT' and the 'ballpen test' as sensory test. They found little difference between the different sensory nerves in the

proportion that improved. Eighty-eight percent of patients showed 'partial or total recovery' of nerve function.[3] A possible explanation for this much higher proportion of improved patients is that these patients received steroid treatment in 'the field' and that, therefore, they may on average have been treated earlier than our patients. In a recent study in Hyderabad, India, Lockwood *et al.* found no improvement of neurological impairment in 7/24 (29%) of patients with neuritis who were treated with (low dose) prednisolone.[22]

Kiran *et al*, report 71% 'good' recovery (no lid gap on gentle closure) in 28 patients with lagophthalmos treated with a low dose steroid regimen (initially 25–30 mg) for 5–6 months.[23] This figure is similar to ours, if the same criteria for 'good' recovery are applied (69%, data not shown). None of the facial nerves deteriorated during treatment (Table 2). Becx-Bleumink found that 84% of lateral popliteal nerves showed improved motor function after treatment,[3] compared to 73% among our patients.

'FUNCTIONAL' NERVE SCORES

To classify impairments into categories that may have some functional meaning, we classified the score before and after treatment into the groups 'absent', 'bad', 'moderate' and 'good', as described above. Our data show that the likelihood of 'good' recovery of both sensibility and motor function was directly related to the severity of the nerve damage at the beginning of treatment (Table 5). This confirms a similar observation by Srinivasan *et al.* for motor nerve function.[5] It is interesting that there was no linear relationship between the extent of neural impairment and ability to recover, i.e. nerves that were clinically completely paralysed were still able to recover, although most of them did not regain full or 'good' function.

TIME TRENDS

The time trends showed that most of the recovery takes place in the first 3 months after initiation of steroid therapy (Figures 3 and 4). It was interesting that 35/64 patients (55%) whose sensory function had improved by 3 months had already improved during the first 2 weeks of treatment. A similar rapid improvement following initiation of steroid therapy was described by Naafs & Dagne.[7] They observed improvement in motor nerve conduction in the first few days of treatment. This they attributed to reduction of the intraneural oedema as a result of the anti-inflammatory effect of steroids. To what extent the further improvement is due to remyelination, regeneration of nerve fibres or both, is, to our knowledge, unknown. The proportion of patients with improvement of sensory and motor function increased very little after 3 months. Improvement in the group of patients with severe neural impairment (bad or complete anaesthesia/paralysis) occurred only during the first 3 months. This 'levelling off' of improvement after 3–6 months was also described by Naafs *et al.*[7,24] and Touw-Langendijk *et al.*[6]

PROGNOSTIC FACTORS

The level of impairment at the beginning of steroid treatment had a significant

independent effect on the outcome even after adjusting for age, sex, steroid regimen and classification. The use of more sensitive nerve assessment instruments, and perhaps testing of more modalities of neural function, should lead to detection of impairment at an earlier stage and will perhaps enable us to identify other prognostic factors. The use of sensitive tests of sensibility has made predictions of prognosis possible in the treatment of nerve injury and chronic compression neuropathy.[25]

Despite some improvement of nerve function in the majority of patients, we are not satisfied with the results. Several patients deteriorated during treatment in hospital. A larger proportion (32–47%) showed no functional improvement at all, despite rigorous therapy for 'recent' impairment. Recent data from Malaŵi showed that even in a well-conducted field programme, 26·2% of patients developed new impairments or worsening of existing impairments during MDT.[26] This led the authors to state that 'the present steroid treatment, even if instituted quickly, is unsatisfactory'. An active search for better methods of treatment and improved regimens is therefore justified.

RECOMMENDATIONS

Further research is needed to clarify the pathogenesis of neuropathy in the different forms of leprosy. Improved understanding should lead to improved treatment.

Controlled, randomized treatment trials of new anti-inflammatory or immune-modulating drugs and/or different steroid regimens are needed to improve therapy of neuropathy.

Early detection of nerve function impairment needs to be improved. Available techniques, like the Semmes-Weinstein monofilaments, should be made widely available and should be taught to all health workers caring for leprosy patients.

Acknowledgments

We are grateful to Professor F. G. I. Jennekens, Dr Y. van der Graaf and an anonymous referee for helpful comments during the preparation of this manuscript. We are indebted to the staff of the Physiotherapy Department at Green Pastures Hospital who spend much of their time performing detailed nerve function assessments, without which this study would not have been possible. The work at Green Pastures Hospital is dedicated to the service and glory of God.

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APPENDIX

Muscles tested in the voluntary muscle test

Facial nerve: Orbicularis Oculi (only)–max score: 5, Ulnar nerve: First Dorsal Interosseus ('index finger out') and Abductor Digiti Minimi ('little finger out')–max score: 10, Median nerve: Abductor Pollicis Brevis and Opponens Pollicis ('thumb up')–max score: 10, Radial nerve: Extensor Carpi Ulnaris ('wrist up') and Extensor Digitorum Longus (finger extension)–max score: 10, Lateral Popliteal nerve: Extensor Hallucis Longus and Peroneus Longus & Brevis ('lateral foot up')–max score: 10. If any particular muscle could not be tested (e.g. because of joint stiffness or previous surgery) or if test data were not available, the results for that nerve were excluded from the analysis.

Sites tested in the touch sensibility test

Ulnar nerve: 3 points, on the pulp of dig. V, over the 5th metacarpophalangeal (MCP) joint and on the hypothemar eminence respectively–max score: 6, Median nerve: 4 points, on the pulp of the thumb, over the 2nd MCP joint, the pulp of the index finger and the pulp of the middle finger respectively–max score: 8, Posterior Tibial nerve: 10 points on the footsole: on the tip of each toe, over the 1st and 5th metatarsophalangeal joints, the instep, the lateral border and the heel–max score: 20. If there was an ulcer on the test site a score of 0 was given for that site. Missing date were handled as for the VMT results.

Lepr Rev (1996) **67,** 119–125

Correlation of skin and nerve histopathology in leprosy

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Accepted for publication 28 November 1995

Summary Discrepancies have been noted in the histopathological findings between skin and nerve lesions of leprosy patients in some recent works. We studied concurrent skin and nerve biopsies in 27 randomly selected leprosy patients to correlate the histopathological features of skin and nerve lesions, and to assess the importance of neural histology in the classification of leprosy.

Skin and nerve biopsies were diagnostic of leprosy in 23 and 26 patients, respectively. A discrepancy was found between the two in 15 cases. Neural histology was helpful in the classification of determinate forms in 24 cases while dermal histology was significant only in 16 patients. A multibacillary nerve and paucibacillary skin picture was observed in 3 patients.

It was concluded that nerve biopsy is more informative and specific than skin biopsy in the diagnosis of leprosy and further helps to classify the patients when the skin histology is inderminate or nonspecific.

Introduction

At present the diagnosis and classification of leprosy is largely based on the characteristic skin lesions, thickened peripheral nerves and the presence of anaesthesia. Demonstration of AFB in slit-skin smears and histopathology of the skin are the commonly-used methods to confirm its diagnosis and classification. Although these criteria are related to the skin parameters, leprosy is primarily a disease of peripheral nerves.[1]

Several discrepancies have been noted in the histopathological features of skin and nerve lesions in leprosy. Some authors observed a higher bacterial load and lower histological grading of the disease in biopsies obtained from the peripheral nerves than from skin.[2–8] These cases, if diagnosed and treated on the basis of skin findings alone, may result in inadequate treatment, thereby contributing towards increased drug

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0305-7518/96/067119+007 $1.00

resistance and relapse of the disease. In contrast, no such discordance was noted in the histopathology of skin and nerve lesions by some other workers.[9,10] The reasons for this anomaly are far from clear and no explanation was accounted. Hence, the present study was carried out to correlate the histopathology of the skin and nerve lesions in concurrent biopsies obtained from different types of leprosy patients and to assess the role of neural histology in the classification of disease.

Material and methods

The material for this study consisted of 27 randomly selected different types of leprosy patients reported to our urban leprosy clinic. They were in the age group of 7–60 years, comprising 21 males and 6 females. The duration of the disease varied from 2 weeks to 10 years. Among these, 20 were new cases without any treatment, while 7 had completed the course of paucibacillary treatment but the disease was still active.

A provisional diagnosis of leprosy was made on clinical criteria according to Ridley–Jopling classification[1] in all cases except the pure neuritic, which were diagnosed as per Indian Classification.[11] These included TT (1), BT (20), BB (1), BL (2), LL (1) and pure neuritic (2). Slit-skin smears for AFB and lepromin test (Lepromin-A) were done and all patients underwent parallel skin and nerve biopsies. Skin biopsies were obtained from the suggestive lesion and from the most hypoesthetic part in pure neuritic cases. Nerve biopsies were taken from pure sensory cutaneous nerves such as radial cutaneous, sural, superficial peroneal or cutaneous nerve of forearm.

The histopathological features were studied in H. & E. stained sections and a bacillary count for AFB was carried out on a logarithmic scale in sections stained with modified Fite–Faraco method. The skin biopsies were classified according to Ridley–Jopling, as described by Ridley.[12]

Indeterminate leprosy: there is no granuloma present but one or more of the following features are seen: a, Infiltration of lymphocytes and histiocytes around skin appendages, nerves and vessels, with or without proliferation of spindle shaped cells in the superficial dermis; b, proliferation of Schwann cells; or c, AFB in nerve, arrector pili muscle or subepidermal zone.

The histopathological criteria laid down by Ridley & Ridley[13] were used for the evaluation of nerve biopsies. Further, the histological diagnosis of indeterminate leprosy and leprous neuritis in the nerve was made according to Job[14] based on either (a) presence of bacill in Schwann cells with the nerve almost looking normal without any damage to the structure, or (b) the perineurium showing some reactive proliferation with infiltration and collection of monocular cell around neurovascular bundles. The nerve parenchyma may be completely destroyed and replaced by hyalinized fibrous tissue with hardly any inflammatory cells in cases of long-standing leprous neuritis (chronic leprosy neuritis).

Results

CLINICOPATHOLOGIC CORRELATION

Skin histology was diagnostic of leprosy in 23 out of 27 patients studied comprising

Table 1. Clinicopathological correlation (skin)

Histological diagnosis (skin)	Clinical diagnosis						
	TT	BT	BB	BL	LL	PN*	Total
TT(s)	1	–	–	–	–	–	1
BT	–	11	–	–	–	–	11
BB	–	–	1	1	–	–	2
BL	–	–	–	1	–	–	1
LL	–	–	–	–	1	–	1
I	–	7	–	–	–	–	7
Non-Specific	–	2	–	–	–	2	4
Total	1	20	1	2	1	2	27

* Pure neuritic leprosy (skin biopsy done from hypoesthetic part).

indeterminate (7), TT_S (1), BT (11), BB (2), BL (1) and LL (1), and the picture was non-specific in 4 cases. Clinicopathological correlation with reference to dermal histology and clinical diagnosis was seen in 15 out of 27 cases studied (56%) as shown in Table 1.

Neural histology was diagnostic of Hansen's disease in 26 out of 27 cases studied constituting indeterminate (1), TT (6), BT (11), B (2), BL (3), LL (2), leprous neuritis (1) and normal picture in one patient. Clinicopathological correlation with reference to the clinical diagnosis and neural histology was noted in 14 out of 27 cases (52%) as shown in Table 2. In BT group concordance was seen in 10 out of 20 patients, followed by one each in TT, BB, BL and LL.

CORRELATION OF SKIN AND NEURAL HISTOLOGY

Histopathology of skin and nerve correlated in 7 BT cases followed by one case each in

Table 2. Clinicopathological correlation (nerve)

Histological diagnosis (nerve)	Clinical diagnosis						
	TT	BT	BB	BL	LL	PN*	Total
TTs	1	4	–	–	–	1	6
BT	–	10	–	–	–	1	11
BB	–	1	1	–	–	–	2
BL	–	2	–	1	–	–	3
LL	–	–	–	1	1	–	2
I	–	1	–	–	–	–	1
Chronic leprous neuritis	–	1	–	–	–	–	1
Normal	–	1	–	–	–	–	1
Total	1	20	1	2	1	2	27

* Pure neuritic.

Table 3. Correlation of skin and nerve histopathology

Nerve pathology	Skin pathology							Total
	TT	BT	BB	BL	LL	I	Others	
TT	1	3	–	–	–	1	1	6
BT	–	7	–	–	–	2	2	11
BB	–	–	1	–	–	1	–	2
BL	–	1	1	–	–	1	–	3
LL	–	–	–	1	1	–	–	2
Indeterminate	–	–	–	–	–	1	–	1
Others	–	–	–	–	–	1	1	2
Total	1	11	2	1	1	7	4	27

*Others include nonspecific histology and leprous neuritis (leprous neuritis diagnostic but not classifiable, so included in others).

TT, BB, LL, indeterminate and others (Table 3). Overall concordance was noted in 12 out of 27 cases (44%).

The neural histology was helpful in the classification of determinate forms (TT, BT, BB, BL & LL) in 24 patients while dermal histology was only useful in 16 patients. This difference was statistically significant ($P < 0{\cdot}02$). AFB were seen in 13 patients altogether, nerve alone (6), skin alone (2) and both nerve and skin (5) patients. Regarding the bacteriologic index (BI) in the biopsies, a multibacillary (MB) picture was seen in 11 nerve and 7 skin biopsies, thereby revealing that nerve lesions had higher bacterial index than concurrent skin lesions (Table 4).

Caseation necrosis was considered to be more indicative of subpolar tuberculoid (TTs) by Ridley.[15] This feature was observed in 6 nerve biopsies and one skin biopsy in our series. Since, we followed the criteria laid out in the nerve biopsy classification of Ridley & Ridley,[13] these cases were included under TTs. The data pertaining to the

Table 4. Bacteriologic index in skin and nerve biopsies

Skin biopsy	No. of cases	Bacteriologic index (BI)		Nerve biopsy	No. of cases	Bacteriologic index (BI)	
		PB	MB			PB	MB
TTs	1	–	1	TTs	6	4	2
BT	11	9	2	BT	11	9	2
BB	2	–	2	BB	2	–	2
BL	1	–	1	BL	3	–	3
LL	1	–	1	LL	2	–	2
Indeterminate	7	7	–	Indeterminate	1	1	–
Nonspecific	4	4	–	Leprous neuritis	1	1	–
				Normal picture	1	1	–
Total	27	20	7		27	16	11

PB means BI = 0. MB means BI = $\geqslant 1+$.

Table 5. Immunological (Mitsuda response) and histological correlation of skin and nerve

	Mitsuda reaction			
Histological diagnosis	−ve	1+	2+	3+
Skin				
TT	–	–	–	1
BT	1	2	3	5
BB	2	–	–	–
BL	1	–	–	–
LL	1	–	–	–
Indeterminate	2	2	2	1
Nonspecific	–	2	–	2
Nerve				
TT	–	–	1	5
BT	–	4	4	3
BB	2	–	–	–
BL	3	–	–	–
LL	2	–	–	–
Indeterminate	–	1	–	–
Chronic leprous neuritis	–	–	–	–
Normal	–	1	–	–

immunohistopathological correlation (Lepromin response) with reference to the nerve and skin were summarized in Table 5.

Discussion

No doubt, the Ridley–Jopling classification[1] is widely accepted, but its histological component refers only to skin with the presumption that there may be no significant difference in the classification of skin and neural histology. However, discrepancies between skin and nerve lesions were noted in the form of increased number of bacilli and a lower, i.e. towards LL, histological grading in nerves than in skin. Srinivasan *et al.*[3] found discrepancies in 21 out of 36 cases which included 6 cases of pure neuritic leprosy. The nerves showed a lower histological grading in most of the cases.[8,13,16,17] We observed discordance between skin and nerve histology in 15 out of 27 patients. The discrepancy in the form of lower histological grading occurring in nerves was observed in 3 cases, i.e. paucibacillary skin and multibacillary nerve.

Ridley *et al.*[18] attributed the discrepancy between skin and nerve in the histological grading to the microreactions occurring in the peripheral nerves. They described these reactions as clinically silent and regular features of peripheral nerve involvement. These hypersensitivity reactions, occurring in nerves alone can be either upgrading or down-grading and can lead to alterations in the classification of nerve lesions locally, without causing much difference in the skin.

The importance of neural histology in the classification of leprosy is less well documented. Mukherjee & Mishra[16] found neural histology to be more useful in the classification of the disease in one third of their patients in whom skin showed

indeterminate or nonspecific features. Srinivasan *et al.*[3] noted that the lesion in the nerve was classifiable in 9 patients while the skin lesion in the same patients could be identified as leprosy but not, classifiable as any particular type. Kaur *et al.*[8] also found nerve histology is more significant in the classification of leprosy. Our findings further confirm this point.

The neural histology was helpful in the classification of determinate forms (TT, BT, BB, BL or LL) in 24 out of 27 patients studied in our series while the corresponding dermal histology was significant only in 16 patients. This difference was statistically significant ($p < 0{\cdot}02$). Skin showed features of indeterminate leprosy or nonspecific changes in 11 cases while the corresponding lesion in the nerve showed granuloma classifiable as TT (2), BT (4), BB (1) and BL (1) in 8 out of 11 cases.

The relevance of lower immunological grading and higher bacterial load in the nerves is debated. Nerves are protected sites for *Mycobacterium leprae* and allow unhindered multiplication of bacilli in the early stages of infection. Kaur *et al.*[8] and Negesse *et al.*[19] described that such patients should be classified as multibacillary on the basis of combined skin and neural histology and treated with MB therapy to prevent relapse and resistance to drugs. We believe that it is an important and logical consideration.

The discrepancy in the skin and nerve bacillary load was explained by Ridley & Ridley,[13] on the basis of delayed recognition of *M. leprae* antigen in the nerve, leading to increased load of bacilli. They also argued that skin harbours the main mass of *M. leprae* in the body and hence the skin classification rather than the nerve, represents the general tissue response. But Negesse *et al.*[19] observed that the patients with MB nerve lesions have low lymphoproliferative assay response regardless of their BI in skin lesions. Hence, they suggested that bacillary load in the nerve is certainly one of the factors in determining the immunological spectrum of the disease. Srinivasan *et al.*[3] showed that 7 out of 8 patients with clinical relapse displayed relapse histopathologically only in nerves. These results are in contrast to the view expressed by Ridley & Ridley[13] that the skin tissue response reflects the general immune status. Our data pertaining to the immunopathological (both skin and nerve) correlation based on Mitsuda reaction using lepromin-A were within established norms. Mitsuda was negative in indeterminate (2) and BT (1) cases based on skin histology. These were found to be BB or BL on neural histology. Nerve pathology correlated more exactly with Mitsuda reaction; TT (5) showed strong Mitsuda reaction with ulceration in 4 of them. BG showed varying picture (1+ to 3+) while BB, BL and LL showed negative reaction. However, Srinivasan *et al.*[3] have observed positive Mitsuda in a case in whom nerve biopsy showed BL features. Kaur *et al.*[21] have also described this in some of their cases.

The role of nerve biopsy in the diagnosis of pure neuritic leprosy is well established. Thirty-eight out of 77 patients with primary neuritic leprosy were confirmed to have leprosy on the basis of nerve biopsy in a study done by Jacob & Mathai.[20] Similar role of nerve biopsy in the diagnosis of leprosy was observed by Kaur *et al.*[21] In our study the diagnosis of leprosy was possible in both pure neuritic cases in nerve biopsy, while normal looking hypoesthetic skin did not show evidence of leprosy. Similarly, no significant pathology was found in the analgesic skin of 39 pure neuritic cases studied by Kaur *et al.*[21] Nevertheless, Pannikar *et al.*[22] found skin biopsy showing features of leprosy even in the absence of skin lesion in 14 out of 27 pure neuritic cases.

M. leprae continue in a viable state in certain sites like peripheral nerves long after they are cleared from the skin. These organisms have been considered as persisters. They

play a vital role in the relapse of the disease. In the present study clinical relapse was seen in 7 cases. Neural histology in these patients showed granuloma classifiable as BT or TT in 5 cases, while skin histology showed classifiable leprosy in only 3 cases. Srinivasan *et al.*[3] found the evidence of relapse occurring only in nerve lesions in 7 out of 8 cases without corresponding evidence in the skin biopsy. Most of these cases showed lepromatous picture. Hence, it is important to keep the persisters in view before considering the patients for release from treatment.

Discrepancy between skin and nerve histology is significant especially in the classification of the disease, with nerve histology adds detail to the evaluation of patient and in turn, we might understand how it reflects the immune response of the patient.

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Long-term follow-up of joint stabilization procedures in the treatment of fixed deformities of feet in leprosy

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Accepted for publication 24 October 1995

Summary This retrospective study of 52 patients, who underwent joint stabilization procedures for static deformities of the feet in leprosy between 1971 and 1985, was undertaken to assess the long-term results of joint stabilization of feet for fixed deformities in leprosy. The main purpose of joint stabilization is to make the feet plantigrade for weight bearing and to make the wearing of footwear possible. Deformities corrected include varus, equinus and equinovarus. Chronic ulceration occurs repeatedly if these deformities are not corrected and leads to inevitable bone destruction and eventual amputation.

Introduction

Fixed deformities involving the ankle and subtalar joints are common in leprosy. They occur as a result of infection, trauma, neuroarthropathy and tissue destruction each contributing to the final position of the foot. In these deformities the plantar skin is deflected away from the line of weight-bearing resulting in areas that normally do not bear weight to lie along the line of weight bearing.[1] Lateral border of the foot in the case of a varus deformity and medial border of the foot in valgus deformity bear weight during walking and are subject to abnormal pressures. In deformities like equinus and rocker bottom foot the forefoot and the midfoot are subject to high pressures during walking. Because of these abnormal pressures chronic ulceration is common at these sites.[2]

Left alone these deformities follow a natural course of repeated chronic ulceration leading to inevitable bone destruction and eventual amputation.[3,4] Hence these deformities necessitate the performing of various joint stabilization procedures to correct deformity, relieve abnormal pressures at these sites and to restore good plantar skin which is deflected away for weight bearing.

Brand recognized the role of triple arthrodesis in correcting some deformities of the good.[5] In 1971 Fritschi discussed the place of arthrodesis in severely deformed feet.[6] Shibata *et al.* reported 73% fusion rate in deformities of leprotic neuropathic feet.[7] This

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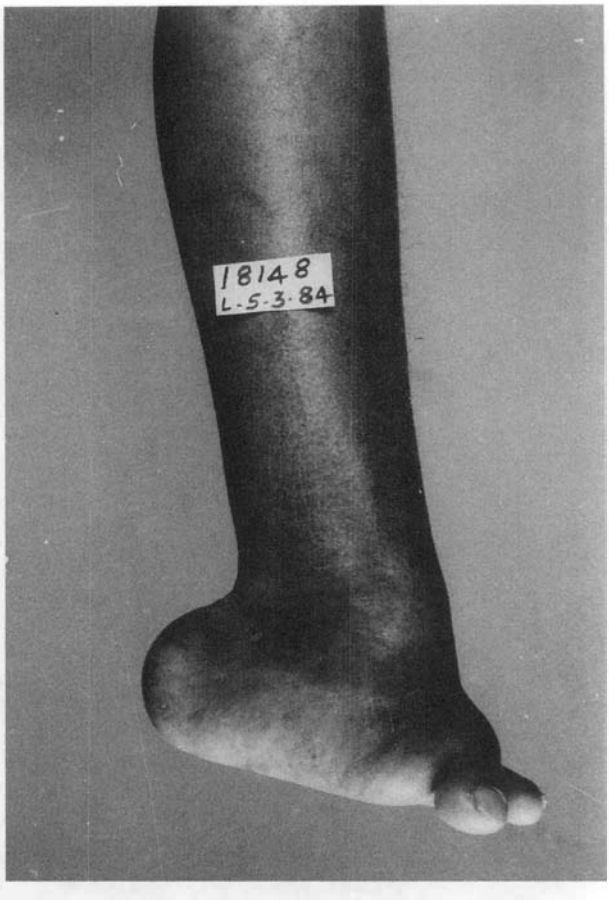

Figure 1. Equinus component of an equinovarus deformity.

retrospective study was undertaken to assess the long-term results of joint stabilization of feet for fixed deformities in leprosy.

Methods

Patients who underwent joint stabilization procedures for static deformities of the feet at the Schieffelin Leprosy Research and Training Centre, Karigiri provide the material for this study.

The main purpose of joint stabilization procedure is to correct the deformity to make the foot plantigrade for weight bearing and to make the foot fit for footwear usage. The type of foot deformities corrected include varus, equinus and equinovarus. (Figures 1–2.)

The following criteria were used in selecting the patient for a joint stabilization procedure: both feet should be ulcer free for at least 3 weeks; the available weight-bearing surface should be more than one third of the normal; there should be reasonable bone stock though there may be disorganization; patients should be willing for six

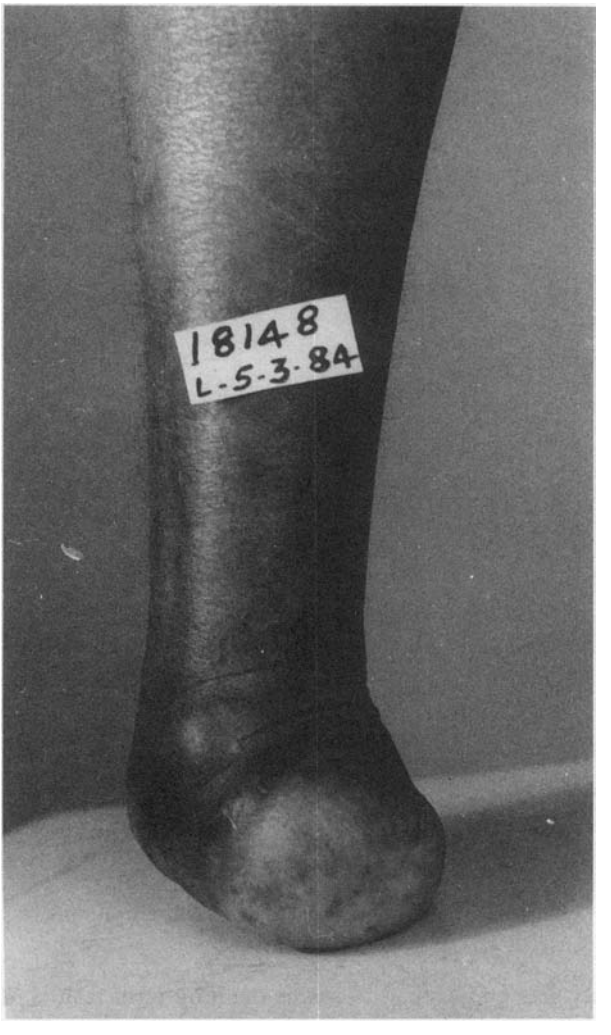

Figure 2. Varus component of an equinovarus deformity.

months of immobilization in a cast followed by the wearing of specialized footwear (which are heavy and costly) for at least one year.

Surgery consisted of adequate exposure of the concerned joints and removal of adequate wedges from the adjacent joint surfaces to obtain correction of the deformity. The corrected position was maintained by means of staples or compression clamps.

Following surgery the foot was immobilized in a nonweight-bearing cast for 1 month. This was followed by weight-bearing casts for the next 5 months at which time the union was checked clinically and radiologically. If the union was satisfactory the patient was provided with a fixed ankle brace to protect the union till consolidation of the union occurred.

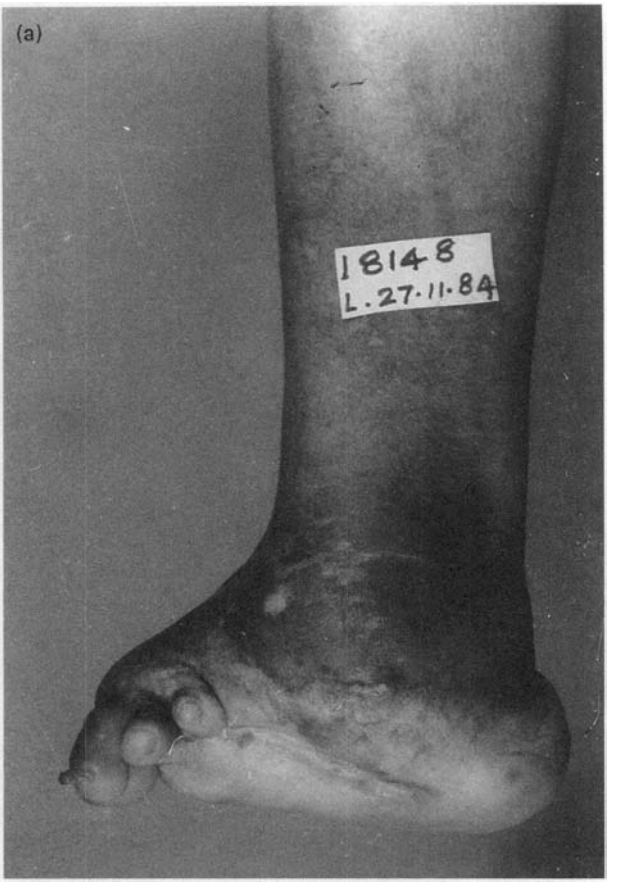

Figure 3(a).

At each follow-up visit the position of the foot, clinical union and ulcer episodes over the follow-up period were noted. These patients were followed up initially at intervals of six months for the first two years and thereafter whenever the patient had a problem with his foot or footwear.

Patients

Fifty-two patients underwent joint stabilization procedures for static deformities of feet in leprosy between 1971 and 1985 at the Schieffelin Leprosy Research and Training Centre.

AGE, SEX AND CLASSIFICATION

The details of age, sex and classification are given in Table 1. Most patients were between

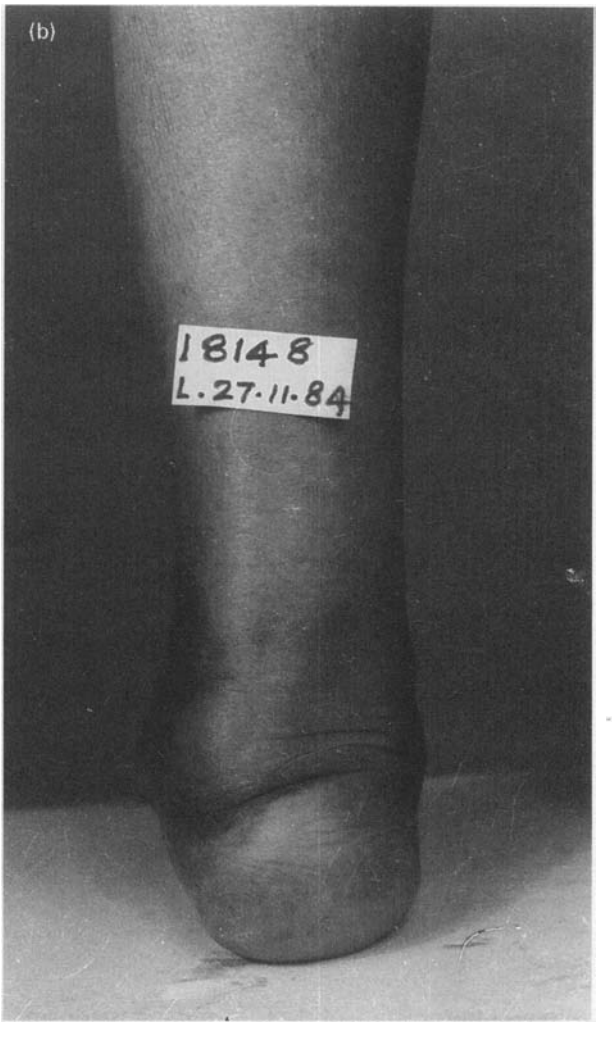

Figure 3. Correction of both equinus (a) and varus (b).

Table 1. Age and sex distribution of patients

Age (years)	Male	Female	Total
21–30	—	2	2
31–40	7	6	13
41–50	18	4	22
51–60	10	3	13
61–70	2	—	2
Total	37	15	52

Table 2. Deformity and site of ulcer

Site of ulcer	Varus	Equinus	Equinovarus	Total
Lateral border	42	1	2	45
Forefoot	1	8	2	11
Total	43	9	4	56

31 and 60 years of age. Thirty-six men and 16 women underwent joint stabilization of the feet. Thirty-four of them belonged to the tuberculoid type and 18 to the lepromatous type. Four patients underwent joint stabilization on both sides making the total number of feet operations, 56.

TYPE OF DEFORMITY AND TYPE OF SURGERY

Type of deformity, details of the ulcer and the type of surgery performed are shown in Table 2. Varus deformity was seen in 43 feet, equinus in 9 cases and equinovarus in 4 cases. There was chronic ulceration or scarring in 45 patients over the lateral border of the foot and in 11 patients in the forefoot. The chronicity of the ulcer varied from 2 years to 20 years.

Subtalar arthrodesis was done in 42 patients, ankle arthrodesis in 10 and pantalar arthrodesis in 4 cases (Table 3). Internal fixation with staples was done in 30 feet and with compression clamps in 18 cases. Eight feet did not have any internal fixation.

FOOTWEAR AND FOOT PRINTS

Fifty-three feet were prescribed a fixed ankle brace and 3 a patellar tendon-bearing brace. Harris mat foot prints were done to check that the distribution of pressure at the time of fitting the footwear was satisfactory in all cases.

FOLLOW UP

Eleven patients were lost to follow up. The profile of patients lost to follow up in terms of age, sex, classification, type of deformity and type of surgery is very similar to the entire group. Two patients had below the knee amputations because of underlying bacterial

Table 3. Deformity and type of surgery

Type of surgery	Varus	Equinus	Equinovarus	Total
Triple arthrodesis	42	—	—	42
Ankle arthrodesis	—	10	—	10
Pantalar arthrodesis		—	4	4
Total	42	10	4	56

Table 4. Results at follow up

	No	%
Position of the foot		
Neutral position	31	72·1
< 10 degrees deformity	9	20·9
10–15 degrees deformity	3	7·0
State of union		
Bony union	43	100·0
Radiological union	43	100·0
Ulcer rate		
(Av. ulcer episodes per year)		
0·00	6	14·0
0·10–0·50	25	58·1
0·60–0·90	10	23·3
1·00 or more	2	4·6

infection. Thus, 39 patients with 43 joint stabilizations left in the study were followed up for an average of 11·93 years (5–24 years). Only patients who were followed up for a minimum of 5 years were included in the analysis of results.

Results

The follow up results are shown in Table 4.

POSITION OF THE FOOT

The position of the foot at follow up was neutral in 31 patients. There was a residual deformity of less than 10° in 9 cases and 10–15° in 3 cases.

STATE OF UNION

At the six-month follow-up visit all feet had sound clinical and radiological union.

ULCER RATE AFTER CORRECTION

The incidence of plantar ulceration during the follow-up period was 0·43 per year per person or 36·1 per 1000 person months.

COMPLICATIONS

As mentioned earlier two patients needed below the knee amputation due to severe bacterial infection. Pin tract infection was seen in three cases which settled down after the removal of pins. Revision of arthrodesis was required in 4 cases. Revision was

required in 3 cases due to recurrence of the deformity, at 2 years, 3 years and 11 years and in one case after 2 months because of incomplete correction.

Discussion

Fixed deformities of the feet having good weight-bearing plantar surface, little scarring and well-preserved bony architecture can be corrected by joint stabilization and present no difficulty in making such a decision. It is when one is faced with a fixed deformity of a foot having reduced plantar surface with gross scarring and disorganized bony architecture that making a decision to salvage the foot as against an amputation becomes difficult to make.

Fritschi felt that correcting and preserving such a limb despite the cost in terms of loss of man hours and restriction of activities of the patient would be worthwhile because it is always preferable for the patient to have a foot of his own which in an emergency he can immediately use without having to find one and buckle it on.[6] The usefulness of this conservatism needed to be clearly proved in the long term since the salvaged anaesthetic foot continues to be at risk of developing ulceration with the possibility of further destruction and the inevitable amputation.

This study demonstrates that joint stabilization has enabled the patient to have the benefits of the use of his own limb on average for more than a decade after surgical correction. The benefits of the surgery were a plantigrade foot for weight bearing and the fitting of footwear. The patient was also relatively free from chronic ulceration of the feet making them more acceptable at home and work.

It has been brought out in the study that even after correction of deformity and appropriate footwear usage the patient is still prone to plantar ulceration since the basic impairment, namely anaesthesia and motor paralysis of the foot has not changed.

Subtalar arthrodesis for correcting a varus deformity and ankle arthrodesis for correcting an equinus deformity are the methods of stabilization recommended. In an equinovarus deformity where both equinus and varus need to be corrected a single-staged pantalar arthrodesis is useful. However, the decision of procedure would depend on the type of deformity and the pattern of bony configuration seen radiologically.

The bony configuration in deformed anaesthetic feet is often distorted and it is difficult to identify normal anatomical landmarks. Because of repeated ulceration, sequestration and neuroarthropathy there is bone loss and the bone stock is often insufficient. The bones of the foot are very soft due to gross osteoporosis making accurate wedge taking difficult and to get an internal fixation in place. Neuroarthropathy was seen only in two cases in this series and in general may not be the main contributing factor in the development of fixed deformities of the feet.

Since most patients (94%) were in their fourth to sixth decades of life, preservation of the patient's own limb helped the patient to contribute positively to the society during the most productive years of his life.

In conclusion correction of static deformities of the feet in leprosy by joint stabilization procedures helps the patient to retain his own limb with all its advantages.

Acknowledgment

The authors would like to acknowledge the help of Mr P. Andrews, Co-ordinator Surgical Department for collection and compiling of data.

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Active surveillance in leprosy: how useful is it?

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Accepted for publication 28 November 1995

Summary In this paper, active surveillance is compared with self-reporting as a method of detecting new nerve function loss in leprosy patients who have completed multidrug therapy (MDT). Five hundred and three patients were selected according to new surveillance guidelines in one part of the Danish–Bangladesh Leprosy Mission leprosy control project working area. Surveillance coverage of 71% was achieved in a 7-month period. During this time, 10 released-from-treatment (RFT) patients from among the study group were found to have acute nerve damage requiring prednisolone treatment. Out of the 10, only 2 were detected actively; the remaining 8 self-reported.

It is concluded that health education given at RFT time is effective in motivating patients to self-report with acute nerve damage, and that the time spent on active surveillance could have been better used in other activities, i.e., case detection.

As a result of these findings, active surveillance has been abandoned in the leprosy control project.

Introduction

Post-MDT surveillance as a means of detecting relapse has for many years been part of the accepted wisdom of leprosy control. For example, *the WHO Guide to Leprosy Control* (1988) states that 'clinical and bacteriological follow-up of cases after the completion of treatment is an important part of the current recommendation for MDT: it is essential for the assurance of success of treatment and for the early detection of any relapses'.[1] Other important reference texts and reviews state the same, or very similar, view.[2–4]

Lately the validity of this rationale has been called into question. The most recent WHO technical report on the Chemotherapy of Leprosy recommends that since the risk of relapse after completion of WHO–MDT is negligible, it is no longer necessary to continue routine annual surveillance. Instead, patients should be taught to recognize the early signs of possible relapse or reactions and to report promptly for treatment.[5]

The early recognition and prompt, effective treatment of leprosy reactions and acute

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nerve damage is very important to prevent disability in leprosy with all its attendant problems.[4] Regular sensory and motor testing has been recommended both during MDT and surveillance as a means of detecting early loss of function.[4,6]

A substantial number of leprosy reactions occur after completion of MDT, especially paucibacillary (PB) cases. Rose & Waters[7] concluded that the majority of Type 1 reactions in BT patients develop within the first 6 months of treatment, but that some may develop up to 3 years thereafter. Fine & Lienhardt[8] in their thorough review of reported studies concurred with this view.

On the face of it, it would seem logical to continue regular active surveillance of leprosy patients after completion of MDT in order to detect and treat acute nerve damage, and ideally that would be best for the patient. However, in busy leprosy control programmes with limited resources it may not be possible to conduct such follow-ups, as in many cases a home visit will be necessary and valuable time will be used chasing an ever-diminishing possibility of diagnosing a reactional episode. Further, annual surveillance has only a 50% chance of detecting nerve damage that has occurred within 6 months, the generally-agreed 'treatment window' for corticosteroid treatment.[4,8] A better approach may be to motivate and educate the patient sufficiently to present to the leprosy clinic if he or she notices any new changes and indeed the WHO technical report on the chemotherapy of leprosy already referred to[5] recommends this. As Rose & Waters put it, 'A short time spent in patient education may save the patient from permanent disability'.[7]

In the small study presented below, the numbers of patients with acute nerve damage requiring corticosteroid treatment found during active surveillance in a leprosy control programme, are compared with the numbers of patients self-presenting to a leprosy clinic with acute nerve damage.

Patients and methods

1 DETAILS OF THE LEPROSY CONTROL PROGRAMME

The study is based in the Danish–Bangladesh Leprosy Mission (DBLM), a large leprosy control project operating in four northern districts of Bangladesh, an area reckoned to have the highest prevalence of leprosy in the country (5/1000).[9] The project covers over 5000 km^2 with a population of 4·3 million. Statistical information relating to leprosy control is given in Table 1.

Table 1. Statistical information relating to leprosy control in DBLM, 1994

New patients detected in 1994	2871
Cases on treatment on 31.12.94	3070
Registered prevalence/10,000	7·13
Proportion of MB cases among new	22%
Proportion with WHO disability grade 2 among new cases	8·08%
Proportion of children among new cases	19·3%
Case detection rate/10,000	6·68
PB/MDT completion rate	95·7%
MB/MDT completion rate	89·4%
MDT coverage	100%

MDT is given as a fixed-dose regimen, as recommended by WHO. Patients are classified as paucibacillary (PB) or multibacillary (MB) on the basis of the total number of skin and nerve lesions and the skin-smear result: 10 or more skin and nerve lesions and/or a positive smear result is taken as indicating multibacillary disease.

New leprosy cases are detected in DBLM by a combination of active and passive case-finding methods. Rapid village surveys are carried out in areas thought by field staff to have a substantial number of cases, and contact surveys of all diagnosed cases are carried out for 2 years among the contacts of PB cases, and 5 years among MB contacts. Mass information campaigns to encourage self-reporting are carried out in the evenings using a slide programme, and in the day among smaller groups using flip charts and handbills.

The diagnosis of leprosy is usually made by experienced leprosy control supervisors at field clinics (of which there are 45) where skin smears are taken and MDT is given. All patients are followed up actively while on treatment, and all patients have sensory testing using a ball-point pen (as recommended by Jean Watson)[10] and 'quick muscle testing' (QMT) using the modified MRC scale[8] at each clinic visit. Any abnormality is immediately referred to the leprosy control supervisor and physiotechnician for confirmation. Patients presenting with reactional states and/or acute nerve damage are given treatment with prednisolone either in the field (according to a DBLM field treatment manual) or admitted to hospital if there are special reasons. Health education is strongly emphasized at each stage of the patient's treatment: diagnosis, case-holding and release from treatment (RFT) in order to improve compliance, increase the patient's understanding of his or her health problem and to motivate the patient to take responsibility for self-care. Of relevance here is the education given at release from treatment: the patient is instructed to come to clinic or visit the local fieldworker if he notices an increase in size or change in colour of his skin patches, or if he develops nerve pain, weakness, tingling or anaesthesia in his hands or feet. In other words, he is taught to refer himself if he develops signs of acute nerve damage/relapse.

2 DETAILS OF THE STUDY

Leprosy control conducted by nongovernment organizations (NGOs) in Bangladesh is coordinated by the Leprosy Coordinating Committee (LCC) of Bangladesh. The LCC has a number of expert subcommittees, and in 1993 the Leprosy Control expert subcommittee looked at the subject of post-RFT surveillance and made some recommendations which were adopted by leprosy NGOs in the country. Their aims were twofold: 1, to maximize post-RFT surveillance in a group at high risk of developing reactions; and 2, to reduce the surveillance interval to 3 months so that any finding of acute nerve damage could have a good chance of successful corticosteroid treatment. Broadly, the high risk groups were defined as all PB cases up to 18 months after the end of treatment; MB cases during treatment only; and all cases (PB and MB) who had had a reactional episode during treatment. The following guidelines were made and adopted in 1994 by DBLM in part of its project area:

MB cases: If no reactions occurred during MDT, no active surveillance.
If a reaction occurred during treatment: nerve function assessment every 3 months until the patient has remained symptom-free for a whole year.

PB cases: After release from treatment, all cases are followed with 3-monthly nerve function assessment for a further 18 months, i.e. 2 years from the start of MDT. If a leprosy reaction occurs during the 2-year period, then 3-monthly examinations are continued until the patient has remained symptom-free for a year.

DBLM's large leprosy control area is divided into 3 'fields', each with separate staff and administration. These surveillance guidelines were adopted in one of the three fields, Thakurgaon, where staffing is highest and where the author was living at that time. From July 1994 to January 1995 careful records were kept of cases found requiring corticosteroid treatment, and how they were detected. The results are presented below.

3 DEFINITION OF A REACTIONAL EPISODE

Without going into detail, the '*DBLM field medical guidelines for the treatment of leprosy reactions*' divides leprosy reactions into Type 1 (inflammation in skin patches ± neuritis), Type 2, and pure neuritis without skin patch inflammation according to clinical findings. The severity of the reaction is also graded. Any case presenting with new nerve function loss (sensory and/or motor) of less than 6 months is started on 'full dose prednisolone treatment' (40 mg starting dose in adults tapering down over 16 weeks) after assessment by the physiotechnician. In this regard, the loss of 1 sensory point on hands or feet detected by ball-point pen testing, or the reduction by 1 point in the MRC muscle strength grade of any of the routinely tested movements was taken as evidence of nerve function loss. It is emphasized here that all patients with possible nerve function loss were examined by at least three staff: the leprosy control assistant, leprosy control supervisor and physiotechnician. All patients have sensory/motor testing at each clinic visit performed by at least one of the team; any abnormality must be confirmed by the other two before prednisolone may be started. Equivocal results were not accepted for prednisolone treatment and in such cases patients were re-assessed the following month. In this way, at the time of the study it was felt that the high sensitivity of such testing was acceptable.

In summary, for the purposes of surveillance unequivocal evidence of *nerve function loss* was taken as indicating the need for corticosteroid treatment.

Results

After explanation of the LCC surveillance rules to the field staff, clinic supervisors prepared a list of patients requiring follow-up. Table 2 shows the number of patients selected and their classification, and surveillance rates achieved.

Most patients required two surveillance visits during the 7-month period; some however were released from surveillance during the study period and therefore only had one visit; others were only made RFT during the study period and only qualified for one visit. For this reason the number of planned surveillance visits was less than expected if all patients had two visits.

Table 3 shows the number of patients with nerve function loss requiring full-dose

Table 2. RFT patients selected for surveillance, classification and surveillance rates achieved July 1994–January 1995, Thakurgaon field, DBLM

Selected patients' MB/PB classification	PB			MB			Total
	461			42			503
	91·5%			8·5%			100%
Ridley–Jopling classification of selected patients	TT	BT	BB	BL	LL	PN	TOT
	92	384	9	5	6	7	503
	18%	77%	2%	1%	1%	1%	100%
Planned surveillance visits				918			
Actual surveillance visits				656			
Surveillance coverage				71%			

prednisolone found by active surveillance compared with those self-reporting for treatment.

Further, an additional 15 patients (14MB, 1PB) self-presented during the period who were *not* included in the study group but who had developed acute nerve damage. Of these 15 patients, 12 presented within 3 months of the onset of their reactional episode.

Discussion

This small study about the value of active surveillance has a number of interesting and important conclusions. First, and most importantly it can be seen that even though the surveillance guidelines were followed reasonably well (surveillance coverage 71%), only a relatively small number of patients with nerve function loss were detected (2). Since most surveillance contacts were conducted at the patients' houses, a large amount of time and effort was expended to achieve this small result.

Second, it can be seen that out of all the patients with acute nerve damage detected (25), only 10 were included by the LCC surveillance guidelines. In other words, if the project had only relied on active surveillance and never received patients who self-referred, 15 patients would have fallen outside of the active surveillance group and would therefore not have received treatment. (Presumably the 8/10 who self-reported despite being in the active surveillance group would have been picked up at an active visit in time.)

Table 3. Patients with nerve function loss detected in the study period

MB/PB classification	PB			MB			Total
	10			0			10
Ridley–Jopling classification	TT	BT	BB	BL	LL	PN	Total
	1	8	0	0	0	1	10
Patients with nerve function loss detected actively							2
Patients self-reporting with nerve function loss							8

Third, it can be argued that the surveillance guidelines followed were inadequate since in this study the majority of RFT patients detected with acute nerve damage were not included in the defined group (15/25). Of particular interest is the fact that all 10 of the patient who developed acute nerve damage during the study period (whether detected actively or passively) were paucibacillary; but 14/15 of the patients not included in the cohort were multibacillary. The guidelines were not at all effective at 'catching' MB cases developing a reaction after RFT.

However, despite the probable inadequacies of the surveillance guidelines, it seems clear that 'passive surveillance', i.e. self-reporting, is effective as a means of finding patients with acute nerve damage since 8/10 patients included in the study presented in this way; indeed, they presented sooner than they would have done had they been detected actively. Out of the group of 15 patients presenting with acute nerve damage not included in the study group, 12 presented within 3 months of the start of the reactional episode, adding further weight to the conclusion that patients present themselves reasonably soon. A patient's ability to recognize early signs of nerve damage is dependent on *health education* received during his treatment period, especially at his last clinic visit. Effective health education can therefore be viewed as a time-saving and very effective alternative to active surveillance.

In our project area, field staff estimated that one surveillance visit required at least one hour of time. If 600 visits were necessary (a few patients came to clinic), then 600 worker-hours were used. During 1994, field staff were also involved in active case-finding using a rapid survey method. It is reckoned that one field worker can examine 100 people a day; and on average 3 new leprosy cases per 1000 population examined are detected. Thus if the amount of time used on active surveillance had been applied to a rapid survey, then 26 new leprosy cases would have been detected—a considerably more valuable exercise in terms of primary prevention of disability.

As a result of these findings, active surveillance has been abandoned as a routine field activity in DBLM.

Acknowledgment

The author is grateful to Dr W. C. S. Smith, Reader in Public Health at the University of Aberdeen, Scotland for his helpful comments and encouragement in this study.

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Lepr Rev (1996) **67,** 141–144

Dry skin lesions with marked hair loss in a case of BL leprosy. A case report

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Accepted for publication 28 November 1995

Summary Skin lesions of leprosy that are anaesthetic, well defined, limited in number and dry with significant hair loss generally fit into the paucibacillary (PB) spectrum. The bacteriological index (BI) is expected to be negative or low. We have reported a case who presented with such findings but whose BI readings were high. Together with the biopsy findings the patient was classified as having borderline (BL) leprosy. The role of the skin smear examination and the misleading nature of some clinical features are highlighted. The authors feel that skin smear examinations should be performed on all leprosy patients at the time of diagnosis.

Introduction

Hair loss over skin lesions is a recognized feature in leprosy. Such a finding over a patch, accompanied with dryness and fine scaling is generally more common in tuberculoid/borderline-tuberculoid (TT/BT) leprosy and is rare and late in the borderline/lepromatous (BL/LL) types.[1,2] We report a case who presented with the majority of their patches showing marked hair loss and dryness in BL leprosy.

Case Report

A 23-year-old male presented to us with asymmetrically distributed patches, less than 10 in number, medium to large in size over the lower limbs, chest and arms. All patches were flat, hypopigmented, dry with fine scales, well defined and showed partial anaesthesia. A few patches showed satellite lesions. Hair loss over the patches was marked, giving the large patches over hairy areas the very distinctive appearance normally noticed in the tuberculoid (TT) end of the spectrum.

Some peripheral anaesthesia, though with some asymmetry, was demonstrable in all four limbs. Nerve trunks were thickened. There was a slight suspicion of fine infiltration of the face. Earlobes were not thick. There was no obvious infiltration

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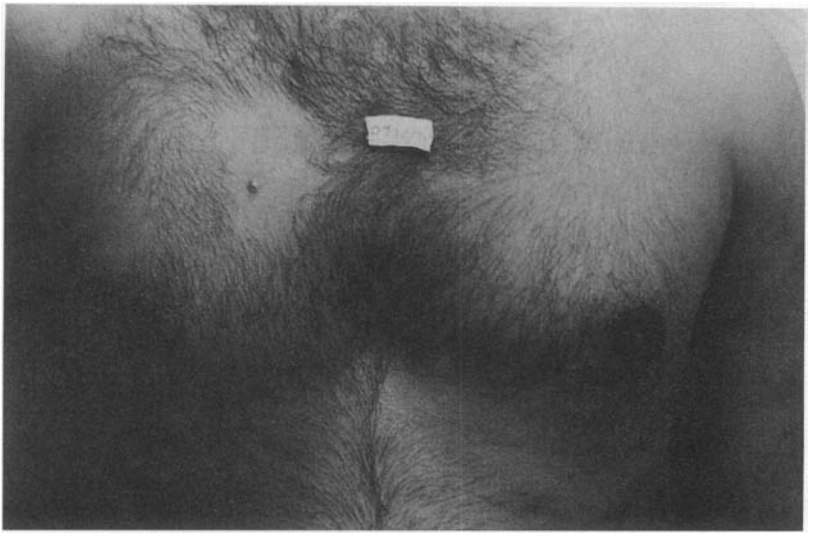

Figure 1. Dry lesion with hair loss over chest with sensory loss.

detectable clinically elsewhere. The clinical classification suspected was that of BT. However, in view of the suspicion of infiltration in the face, a slit-skin smear examination was done before deciding on therapy. Smears were taken from both earlobes, both thighs, both upper arms and from a few patches. The bacteriological index (BI) was found to be 5·25+ and morphological index (MI) was negative which made us classify him as BL leprosy. A 4-mm punch biopsy taken from a dry partially anaesthetic patch with total hair loss was reported as BL leprosy. Sections showed small macrophage granulomata within the dermis. There was both superficial and deep inflammation with nerve involvement. In some granulomas, collections of lymphocytes were prominent and there were occasional giant cells. Early epithelioid cell formation was also present. However most of the cells were vacuolated macrophages which contained numerous Wade-Fite positive acid-fast bacilli. All of the organisms present appeared to be beaded and occasional small globi were present. The patient was put on WHO recommended MB MDT. He developed mild ENL and is being treated appropriately.

Discussion

This case is being presented owing to the interesting nature of presentation of this highly bacilliferous patient. The BI by slit-skin smear from all sites examined was not less than 5+ despite absence of obvious clinical infiltration. BI values at the biopsy site which was a dry hairless lesion with partial anaesthesia was noted to be 4+. The total number of patches in this patient were less than 10.

At least two issues emerge out of this. The first relates to the role of skin smear examination. It has been stated that in most cases it is possible to diagnose leprosy and distinguish between multi- and pauci-bacilliary cases on clinical grounds.[3] In addition

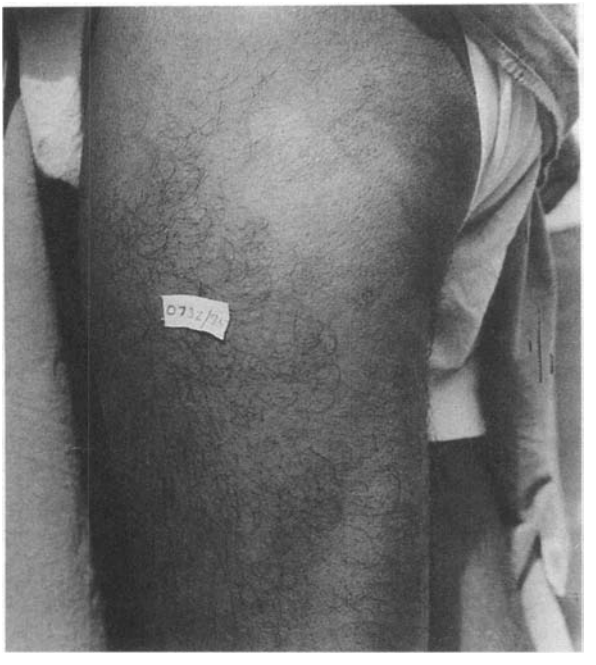

Figure 2. Lesion with hair loss over left thigh and partial sensory loss.

the validity of skin smear results are also being questioned.[4,5] In our case there is the possibility of the patient having recently downgraded from BT to BL. However, this should not affect the patient's disease being classified as MB and treated thus. The peripheral anaesthesia and the early fine infiltration of the face were difficult to detect and are likely to be missed in rapid field surveys. Therefore, in our opinion, skin smears are still essential before starting MDT in all cases.

The second relates to the lesion count. Counts of lesions or body areas involved are now gaining ground as alternative methods in classifying patients as PB or MB.[6,7] In the National Leprosy Eradication Programme in India, counts of BT cases with 10 or more lesions receive MB treatment, irrespective of their skin smear status.[7] In the case presented here if the skin smear examination had been omitted the patient would in all likelihood have received a PB regimen. Therefore, in our opinion classifications of leprosy based purely on the number of patches and its features, e.g. dryness and hair loss, while the skin smear examination is either missed or deferred at the time of diagnosis, even if for logistic reasons, may result in multibacillary patients being classified as paucibacillary and treated thus. The present case highlights the need for a skin smear examination at the time of diagnosis. There is also a case for thorough clinical examination at the time of diagnosis. The finding of lesions with total hair loss in almost all skin lesions in a case of BL leprosy is noteworthy.

Acknowledgments

We are grateful to Dr Ian A. Cree, Senior Lecturer, Institute of Ophthalmology,

University of London, London, for kindly performing histopathological investigation of the biopsy specimens. We are also thankful to Mr S. I. Latkar and P. Dhinakaran for typing the manuscript.

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Letters to the Editor

CASE REPORT: CUTANEOUS LYMPHOMA AND BORDERLINE LEPROSY SIMULATING LEPROMATOUS LEPROSY

Sir,

A 25-year-old severely ill young woman presented with generalized infiltrated skin and dusky red, infiltrated dermal papules and nodules on her face, back, forearms and thighs (Figures 1–3). The nodules were non-tender. Her earlobes were also infiltrated. The lesions had been present for 1 month only.

On examination she was found to have a hypopigmented, anaesthetic lesion over her forehead and asymmetrical enlargement of both ulnar nerves, both radial cutaneous and both lateral popliteal nerves. There were glove and stocking anaesthesia of all four extremities. Physical assessment was, however, difficult because of the patient's general condition. She had a low fever of 38°C, and a large, firm spleen palpable extending 10 cm below the costal margin, and generalized lymphadenopathy. Her blood haemoglobin level was 7·7 g/dl, white count 22,750/ml with a 68% lymphocytosis. The patient was 4 months pregnant.

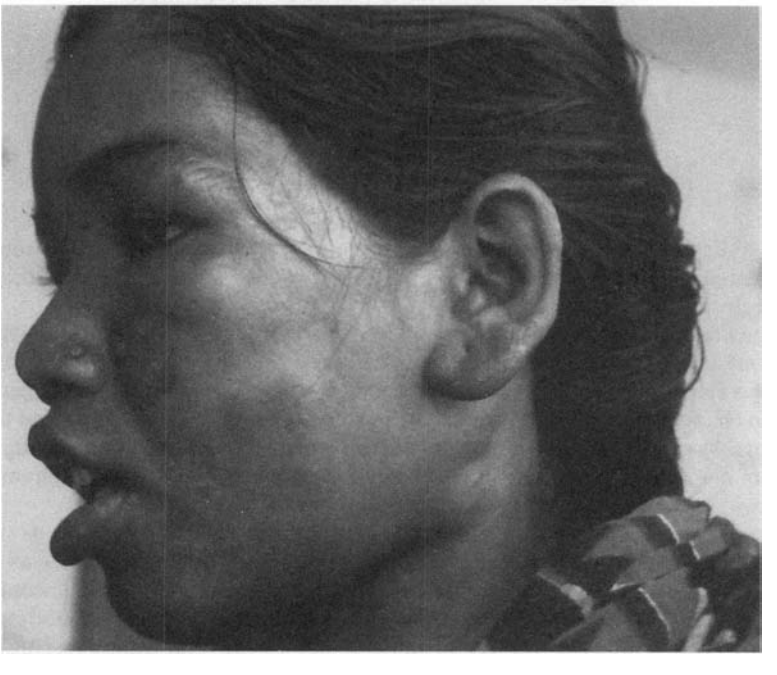

Figure 1.

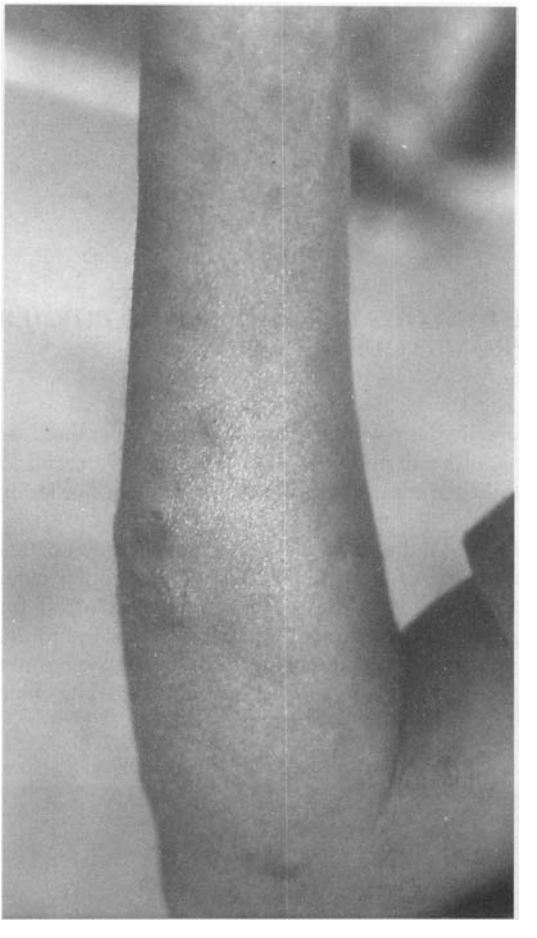

Figure 2.

Initially a diagnosis was made of lepromatous leprosy with an ENL reaction complicated by tropical splenomegaly syndrome. However, the absence of pain or tenderness of the skin lesions was against the diagnosis from the start.

When the laboratory technician attempted to perform a split-skin smear, he obtained not the usual fluid but a white pus-like discharge. No AFB could be detected on several repeat smears but the smear was found to be loaded with lymphocytes. It was at this point that we began to consider that the skin changes we were observing might be something other than leprosy and the diagnosis of lymphoma was made. A skin biopsy was taken which was reported as showing dense focal collections of immature lymphoreticular cells consistent with a diagnosis of lymphoma cutis, high grade. No evidence of epidermal tropism was seen.

Two cases have been reported of cutaneous lymphoma masquerading as lepromatous leprosy.[1,2] However, in this case cutaneous lymphoma did not only masquerade as leprosy, but leprosy was undoubtedly also present, thus causing even more initial diagnostic confusion.

Cutaneous infiltration by lymphomas are not uncommon, being more frequently seen with the non-Hodgkin's type of disease. In this case the absence of epidermal tropism is consistent with a diagnosis of B-cell lymphoma. The usual presentation of such a malignancy is of multiple

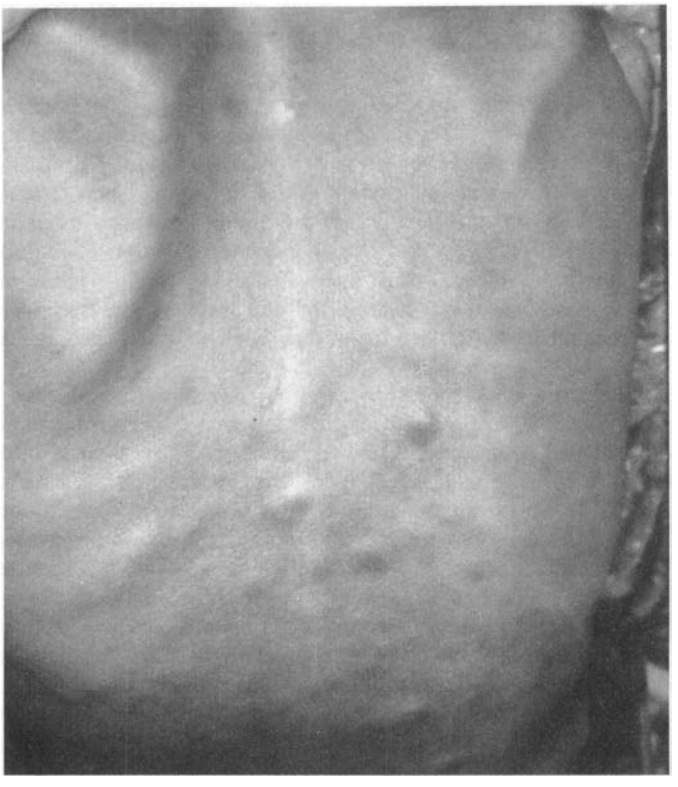

Figure 3.

cutaneous nodules with lymph node, spleen and liver involvement. The cutaneous nodules are deep seated and often affect the lower limbs.[3]

In this case, since the patient reported to a leprosy hospital, a diagnosis of leprosy was rapidly made and the diagnosis of lymphoma only made later. Probably, had the patient presented to a general physician the lymphoma diagnosis would have been made much earlier and perhaps the leprosy missed unless nerves were specifically palpated!

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COMMENT: TRAINING IN LEPROSY: THE TRAINING NEEDS FOR AFRICA, AND THE ROLE OF LARGE TRAINING INSTITUTIONS

Sir,

We would like to offer some additional comments following the Editorial by Dr A. C. McDougall on *Training in Leprosy*.[1] We think that the debate so keenly urged by Dr McDougall is already under way. Future strategies for leprosy training are seriously being discussed by many of the leading training centres and their funding and operational partners across the world. ALERT, the All-Africa Leprosy and Rehabilitation Training Centre, has been providing training in the field of leprosy for over 30 years. Following the introduction of multiple drug therapy (MDT) during the nineteen eighties, ALERT experienced a steady increase in trainees which peaked in 1991. At the same time, it was realized that the dramatic decrease in leprosy prevalence as a result of MDT would necessarily lead to strategic changes, and hence to changes in training needs.

Vertical programmes are no longer seen as either necessary for effective control or cost effective. At the same time, the focus of control programmes is moving from a mainly clinical to a more public health oriented perspective. The integration of leprosy control into primary health care will result in a shift from training leprosy specialists towards training general health workers at different levels of the professional hierarchy, for whom leprosy will not be a full-time preoccupation. As mentioned by Dr McDougall, many programmes have recognized the need to train general health staff. It is thought this type of training should be organized locally within the programme. Thus, the role of the large training institutions should be to train the trainers.

Since 1992, ALERT has been offering Training of Trainers Courses. At the same time, a rapid decrease in the number of trainees was observed. Initially it was thought that this decrease was a result of the success of decentralizing the training towards the local programmes. Unfortunately, this does not seem to be the case. There has been a steady decline in the interest for the Training of Trainers Course, and in 1995 it had to be cancelled due to lack of participants. In addition, the type of trainees coming to this course did not correspond to the profile ALERT had hoped for: instead of senior staff at the regional or national level with clear human resource development and decision-making responsibility, most participants worked at the peripheral level, training being only one of their many tasks. Thus, the ALERT Training of Trainers Course did not seem to correspond to the training needs of African programmes. Not only the Training of Trainers Course, but other courses have been attracting fewer and fewer participants since 1991. This was happening not only at ALERT, but also at other leprosy training centres like Karigiri.[2] Dr McDougall speculates about possible reasons: irrelevant courses; unsatisfactory course quality; lack of cases for demonstration; shift in funding agencies' interest?

In order to find some answers, ALERT decided to try to assess the training needs for Africa in the field of leprosy, and the role of training institutions like ALERT, by sending out a questionnaire, to be followed by a workshop and country visits. We would like to present the results of our questionnaire. Although they mainly focus on Africa and ALERT, many of the issues raised by Dr McDougall are addressed, and we think some general conclusions relevant to leprosy programmes worldwide may be drawn.

A total of 92 questionnaires were sent out to all ILEP members (21), to 20 African National Leprosy Control Programmes, to 33 ILEP representatives in Africa and to various international organizations and nongovernmental organizations (18), as well as a few individuals, involved in leprosy work and training. In spite of obvious mail delivery problems, 30 replies were received, an overall response rate of 33%. For the National Programmes, the response rate was 50%. Apart from general comments from ILEP members and other organizations, we received specific replies from 16 countries, 12 of them anglophone.

It is clear from the replies that many leprosy programmes, following the dramatic reduction in prevalence after the introduction of MDT, have sought new ways to preserve the efficiency and efficacy of leprosy control work. Of the 16 countries who provided data, only 3 still run a purely

leprosy programme. In 1, leprosy is combined with dermatological services and in 12, leprosy is combined with tuberculosis. In 6 of these, the combined programme is integrated in the primary health care infrastructure. This change in programme organization results in changing needs for training as well. Indeed, 13 countries (81%) would like to redefine their training priorities according to the reorientation of the programme.

Two main trends emerge from the replies to the questionnaires:

1. Towards building up the local training capability within the programme.

All programmes already organize local training courses. However, 11 out of 16 expressed the need to improve their teaching expertise. The 8 anglophone countries among these 11 would like ALERT to assist them, notably in the fields of training needs assessment, curriculum development, training materials production and course facilitation. It should be pointed out that this is not a totally new trend. The Training of Trainers Course, mentioned above, was already an attempt to address these issues. As the course was not successful, it may be that a different kind of service is more appropriate. Instead of Training of Trainers courses at ALERT, the respective programmes might be better served by visits by consultant experts. ALERT has considerable expertise available, and it may be useful in future to promote this alternative approach to local capacity building. In situ consultancy services have been provided recently to China, Myanmar, Nigeria, Uganda and Chad, and such advisory and consultancy services should be a major growing point for ALERT in the future.

It should also be mentioned that 10 out of 16 countries complain of a lack of training materials. This is a surprising observation, since so many books and brochures in various languages are available through TALMILEP (Teaching and Learning Materials in Leprosy), often free of charge or at modest cost. Could it be that many programmes are not aware of the available materials? Or do they lack access to them? Or do the available materials not correspond to the needs of the programmes? It may be worthwhile for TALMILEP to look into this matter.

2. Towards a more flexible and diversified training programme at ALERT.

The role of large training institutions has often been questioned. However, as Dr McDougall points out, such institutions have been quite successful in the past in achieving their set objectives. From the replies to the questionnaire, it emerges there should also be a role for ALERT as a training institution in the future, but offering different types of courses. Most programmes would like to send trainees for shorter courses dealing with combined leprosy–tuberculosis control programmes, which should pay particular attention to programme management, supervision, epidemiology, statistics, IEC (information, education and communication) and health education materials production. This seems to confirm the recommendations of the Workshop on Training at the 14th International Leprosy Congress in Orlando in 1993.

It is a little worrying though that very few programmes mention the need for training in clinical leprosy. As the prevalence of leprosy will hopefully continue to decline, leprosy workers everywhere will see fewer and fewer cases, and it will be very difficult to maintain the necessary diagnostic and therapeutic skills. This will be the case especially when leprosy control is integrated into primary health care, and many health workers will be confronted with only a few leprosy cases annually. Although the number of prevalent cases is also dwindling rapidly at large programmes like ALERT, the number of newly detected cases still remains constant and many patients are followed for care after cure. Thus, such large programmes may turn out to be the most suitable option to preserve the necessary expertise. The need for this expertise is clearly stressed in the questionnaire replies. A centre like ALERT is needed to provide specialist training to physiotherapists, surgeons, laboratory technicians, eye care workers etc.

Thus, many of the reflections made by Dr McDougall are confirmed by our questionnaire. ALERT has adapted its training programme accordingly. New courses on Social Rehabilitation, Training Methodology, Prevention and Management of Disabilities, and Information, Education and Communication (IEC) have been scheduled, as well as a basic leprosy and tuberculosis course for administrative staff. In 1996, the courses will be shorter, and the traditional courses for

physicians, supervisors and programme managers will focus on combined leprosy–tuberculosis programmes. All will have modules dealing with health promotion, programme management, supervision and evaluation. A module dealing with clinical aspects will be included as well. In addition, the trainees will be given the opportunity to choose individual training options related to their specific needs and interests. The in-service training will also be organized in a more structured way. This will allow for better planning, tailor-made to the needs of the trainee, and more efficient evaluation and follow-up both for the trainee and the training supervisor. In this context, special attention will be paid to Prevention of Disabilities (POD), particularly focusing on home-based and self-care family support groups, and Preventive and Rehabilitative Surgery (PRS), leading to effective low-tech, field-based strategies for ulcer management.

Some of these changes have already been introduced, in a limited way, in 1995. It also transpires that the number of trainees in 1995, for the first time in several years, has jumped up considerably. This, hopefully, indicates that we are on the right track. ALERT could capitalize on its expertise by linking up with other institutions and expert individuals, and thus become the focal point of a network providing training expertise in leprosy and other, carefully defined, diseases to Africa and the world.

Even if the goal of 'elimination of leprosy by the year 2000' is reached, leprosy will not have disappeared, and the need for constant vigilance, and thus, continuous training, will remain for many years into the next century.

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Teaching Materials and Services

WHO. A Guide to Eliminating Leprosy as a Public Health Problem. First Edition, 1995.

This important document has been prepared by the *Action Programme for the Elimination of Leprosy*, WHO, Geneva. The Preface, by the Director of the Programme, Dr S. K. Noordeen, reads as follows:

> 'We have never come so close to seeing leprosy conquered. Even though the disease continues to afflict a large number of people, it is now possible to eliminate it as a public health problem. As a result of the very encouraging results from 10 years' intensive use of treatment based on a combination of antileprosy drugs, known as multidrug therapy (MDT), the World Health Assembly in 1991 resolved to eliminate leprosy as a public health problem by the year 2000. Later, a WHO Working Group on Leprosy outlined the strategy for eliminating the disease and, since then, practically all the major endemic countries have implemented action plans to eliminate the disease.
>
> The central part of the elimination strategy is to make the WHO-recommended MDT accessible to all patients, including those living in difficult to reach areas and populations.
>
> The purpose of this Guide is to enable every health worker in endemic countries to contribute to the historic task of reaching all leprosy patients with MDT and attaining the goal of eliminating leprosy as a public health problem. Although the Guide is likely to be useful for health workers at all levels, it is targeted mainly at those who have major responsibilities for organizing and implementing leprosy work in the field. It can be used both as self-learning material as well as material for training courses.
>
> The Guide aims to give a clear picture of what needs to be done to implement MDT and attain the elimination goal. It does not attempt to cover every aspect of the disease and is certainly not meant to replace textbooks on leprosy. Only the most important concepts are discussed and details of action to be taken, including technical steps, are given. Users may refer to the documents listed at the end of the Guide for further information.
>
> The Guide has been prepared through contributions from Dr M. Virmond, Brazil, and staff of the Action Programme for the Elimination of Leprosy at WHO Headquarters in Geneva. Acknowledgement is made to the various WHO publications and documents on leprosy and leprosy elimination, and suggestions from a number of experts.'

The main sections include the following: The disease: leprosy; eliminating leprosy; diagnosis of leprosy; classification of leprosy; organizing diagnostic services; treatment of leprosy; management of complications; patient care and referral activities for disability prevention and management; organizing MDT services; patient card (sample); selected reading material. The emphasis throughout is on the presentation of guidance on the most important operational aspects and the implementation of multiple drug therapy, avoiding uncertainties and confusing choices of action. Selected examples of the subject matter and presentation are as follows:

Page 8. Current situation
The top 25 endemic countries contribute 92% of the estimated leprosy cases in the world whilst the top 5 countries contribute more than 80%. In 1995, there were an estimated 1·8 million cases in the world, most of them concentrated in South-East Asia, Africa and the Americas. Among these 1·3 million were registered for treatment of whom 1 million were being treated with MDT. The number of new cases detected worldwide each year is about half a million.

WHO Region	Registered cases	Detection	MDT Coverage %
Africa	113 650	47 900	80·60
Americas	195 891	36 623	65·85
Eastern Mediterranean	23 219	6504	81·51
Europe	4916	–	47·38
South-East Asia	913 664	456 882	76·38
Western Pacific	40 508	12 737	97·70
Total	1 291 848	560 719	76·17

Page 13. Essentials of the elimination strategy
The main thrust of the strategy to eliminate leprosy is to:

expand MDT services to all health facilities;
ensure that all existing and new cases are given appropriate MDT regimens;
encourage all patients to take treatment regularly and completely;
promote awareness in the community about leprosy so that individuals with suspicious lesions will report voluntarily for diagnosis and treatment;
set targets and time-table for activities and make all efforts to achieve them; and
keep good records of all activities in order to monitor the progress towards elimination.

Page 29. Who is likely to report to the health centre?
The persons reporting to the health centre for diagnosis and treatment of leprosy are the following:

Persons reporting	Action to be taken
Leprosy cases who were never treated before	Examine carefully, diagnose, classify, explain facts about the disease and treatment, start MDT.
Leprosy cases who had treatment with dapsone in the past	Ask details of past treatment, check records if available, if MB start MDT. If PB, examine carefully, if signs of active leprosy present, start MDT. If no active signs present, reassure, explain facts about the disease. In case of doubt, start MDT.
Leprosy cases who had treatment with MDT in the past	Ask details of past treatment, check records if available, examine carefully. If a full course of appropriate MDT regimen was completed, reassure, explain facts about the disease and advise to return if necessary. If not, start MDT.
Suspect cases	Examine carefully, if no signs of leprosy, reassure, explain facts about the disease and advise to return if necessary. If in doubt, refer.

Other conditions causing skin lesions	Examine carefully, diagnose and treat skin condition, or refer.
Other conditions causing nerve damage	Examine carefully, diagnose and treat condition or refer.
Contacts of leprosy patients for check up	Examine carefully. If a cardinal sign is present diagnose, classify and treat. If not, explain facts about the disease, advise to return if necessary.
Normal individuals for information and/or check up	Examine carefully, explain facts about the disease, clear doubts.

Before you announce the diagnosis of leprosy to the person and his or her family: Think again—Check your findings—Reconfirm the cardinal sign/s. If in doubt: Explain. Wait. Follow-up. Refer.

Page 60. Selected reading material

1 *Chemotherapy of Leprosy for Control Programmes.* Report of a WHO Study Group, TRS 675, 1982.
2 *WHO Expert Committee on Leprosy*. Sixth Report, TRS 768, 1988.
3 *Chemotherapy of Leprosy.* Report of a WHO Study Group, TRS 847, 1994.
4 *Report of the International Conference on the Elimination of Leprosy as a Public Health Problem.* Hanoi, Viet Nam, 4–7 July 1994.
5 *Risk of Relapse in Leprosy*. WHO/CTD/LEP/94.1.
6 *WHO Weekly Epidemiological Record*, June 1995.
7 *Global Strategy for the Elimination of Leprosy as a Public Health Problem*. WHO/CTD/LEP/94.2.
8 *A Guide to Leprosy Control.* Second Edition, WHO, Geneva, 1988.
9 *Managing Programmes for Leprosy Control.* WHO Training Modules, 1993.
10 *Prevention of disabilities in patients with leprosy. A practical Guide.* WHO, Geneva, 1993.
11 *Elimination of Leprosy, Questions and Answers*, WHO/CTD/LEP/93.7.
12 *MDT—Questions and Answers.* WHO/CTD/LEP/91.3.
13 *Prevention of Blindness in Leprosy.* Revised Edition. The International Centre for Eye Health, London, 1991.
14 *On Being in Charge—A guide to management in primary health care*. Second Edition, WHO, Geneva, 1992.
15 *Leprosy*. Edited by Hastings, R. C., Churchill Livingstone, Edinburgh, Second Edition 1994.

Document reference: WHO/LEP/95.1. *Action Programme for the Elimination of Leprosy*, WHO, 1211 Geneva 27, Switzerland.

Schieffelin Leprosy Research and Training Centre, Courses for 1996*

Course	Qualifications	Duration	Commencing date
I *Courses recognized by the Government of India*			
1 Ophthalmic aspects	Qualified medical personnel in leprosy	1 week	Mar 4–Mar 9 Sep 9–Sep 14
2 Nonmedical supervisors'	Qualified paramedical workers with min of 5 years of field experience	3 months	Apr. 1–Jun. 29
3 Medical officers'	Medical personnel engaged in leprosy work	6 weeks	Jul. 29–Sep. 8
4 Physiotherapy technicians'	+2 passed or PUC (with science subjects)	12 months	Jul. 1–Jun. 29
5 Laboratory technicians'	+2 passed—Science graduates preferred	12 months	Jul. 1–Jun. 29
6 Paramedical workers'	+2 passed (Science Graduates preferred)	5 months	Jul. 1–Dec. 31
7 Smear technicians	+2 passed (with science subjects)	3 months	Sep. 8–Dec. 21
8 Dip. in Prosthetic & Orthotic Engg.	+2 passed (Science Graduates preferred)	30 months	Jul. 1–Jun. 30
II *Other courses offered by the Institution*			
1 Condensed course in leprosy	Nonmedical personnel	1 week	Mar. 11–16 Sep. 16–21
	Medical personnel	1 week	Mar. 4–9 Sep. 9–14
2 Refresher course in skin smears	Trained laboratory technicians	2 weeks	Apr. 22–May 4 Aug. 19–31
3 Eye care in leprosy	Paramedical workers/NMS	1 week	Mar. 20–25
4 Ophthalmic nursing care in leprosy	Nursing technician students, Staff Nurses	2 weeks	May 13–25
5 Programme management issues in leprosy control	Project officers and supervisory level in leprosy control projects	2 weeks	Mar. 18–30
6 Research methods in leprosy	Medical personnel	1 week	Oct. 14–19
7 Training of trainers	Teaching personnel	2 weeks	Mar. 18–30
8 Medical records technology	+2 passed	12 months	Jul. 1–Jun. 29
III *In-service training*			
a Inservice training in medicine, surgery, surgical rehabilitn. pathology, lab. technology, ophthalmology & epid. and lep. control	For qualified medical personnel/ health professionals	3 months	By arrangement
b Medical record keepers	+2 passed with proficiency in in typing and good English	2 months	By arrangement
c Basics of physiotherapy in leprosy	Bachelor in physiotherapy	1 week	By arrangement
d Medical students	Clinical medical students	1 week	By arrangement
e Psychosocial aspects in leprosy	Nonmedical personnel	1 week	By arrangement

* Courses are run every year, but check with Centre for dates early in 1997. The address is given at the end.

Mailing Address: Director/Head, Branch of Training/Training Officer, S.L.R. and T. Centre Karigiri, 632 106, N.A.A. Dist., Tamil Nadu, S. India. Telephone: (0416) 21522; Fax: 91-416-26759; Telegram: 'LEPSEARCH' Vellore-7.

The Erasmus Summer Programme—25 Courses in Quantitative Medical Research

The above is to be held in Rotterdam, The Netherlands, 12–30 August 1996.

The Erasmus Summer Programme offers 25 courses on the principles and methods of quantitative research in medicine and public health in a 3-week programme. The first week provides introductory courses, the second week methodology courses and the third week advanced courses. It is possible to subscribe for 1, 2 or 3 weeks in one of the disciplines Clinical Research, Epidemiology, Health Services Research, Human Drug Research and Human Genetics or to mix and match courses from different disciplines in order to design your own individual programme.

Week 1
Principles of Research in Medicine and Epidemiology. *Albert Hofman*
How to Write a Medical Article. *Stephen Lock*
Introduction to Data-analysis. *Theo Stijnen*
Clinical Decision Analysis. *Job Kievit and Jacobus Lubsen*
Clinical Genetics. *Dick Lindhout*
Introduction to Health Services Research. *Johan Mackenbach and Frans Rutten*
Epidemiology for Clinicians. *Albert Hofman*
Policy Analysis in Health Care. *Tom van der Grinten and Bradford Kirkman-Liff*

Week 2
Regression Analysis. *Stanley Lemeshow*
Methods of Clinical Research. *Diederick Grobbee*
Methods of Public Health Research. *Johan Mackenbach*
Genetic Epidemiology. *Lodewijk Sandkuijl, Bertram Müller and Cornelia van Duijn*
Epidemiology and Health Policy. *Louise Gunning*
Design, Conduct and Analysis of Clinical Trials. *Jan Tijssen*
Meta-analysis. *Anders Ahlbom*
Research in General Practice. *André Knottnerus and Arno Hoes*
Data Handling in Epidemiologic Research. *Michael Koenders and Ronald Stolk*

Week 3
Statistical Modelling in Epidemiology. *Michael Hills*
Advanced Study Design. *Olli Miettinen*
Pharmaco-epidemiology. *Paul Stolley*
Advanced Genetic Association Studies. *Lodewijk Sandkuijl and Cornelia van Duijn*
Medical Technology Assessment. *Paul Kind and Frans Rutten*
Molecular Genetics for Clinicians and Epidemiologists. *Peter Heutink and Ben Oostra*
Human Drug Research. *Adam Cohen and Arno Hoes*
Health Economics. *Wynand van de Ven and Eddy van Doorslaer*

Seminar series:
Sir Richard Doll (Oxford University);
Paul Stolley (University of Maryland);
Dimitrios Trichopoulos (Harvard University);
and *Henrik Wulff* (University of Copenhagen).

The Erasmus Summer Programme is meant for those involved in quantitative research, including clinicians, public health practitioners, research officers, epidemiologists, pharmacologists, biostatisticians and geneticists.

Upon request, a brochure with detailed information on the courses, the extracurricular programme, accommodation and an application form will be sent to you. Further information:

Ms Yvette Schunselaar, Office for Post Graduate Medical Education, Erasmus University Medical School, PO Box 1738, 3000 DR Rotterdam, The Netherlands. Phone: +31 (0)10 408 7881; Fax: +31 (0)10 436 7271; E-mail address: secr@paog.fgg.eur.nl.

WHO: SAPEL Projects gather momentum

LEP News, December 1995, WHO Action Programme for the Elimination of Leprosy gives examples of special action operations in Brazil and Chad:

The objective of Special Action Projects (SAPEL) is essentially to accelerate MDT coverage in difficult areas, firstly by identifying special situations and populations requiring rapid action, and then by developing and putting into effect innovative and feasible strategies. They will normally be of limited duration and, once each project ends, the national leprosy elimination programme will be expected to sustain any further activities that may be required. The experience gained will be of value in improving activities in other areas of the country that face similar problems.

The WHO Secretariat's role is to coordinate and cooperate with other agencies in the projects, while international NGOs and other donor agencies are invited to participate and to provide funding.

Amazonas State in Brazil and Eastern Chad offer two examples of SAPEL operations in the field. Amazonas embraces more than 1·5 million sq. km. in northern Brazil, with a population of just over two million—essentially farmers, fishermen or rubber plantation workers—living in widely scattered communities along the Amazon River and its tributaries. More than 20,000 patients have been started on MDT since it was introduced to the State in 1982. But a major difficulty encountered by leprosy workers is the long time spent by patients in collecting drugs from health centres; vast distances are involved and boat transport is both slow and expensive.

The SAPEL project seeks to improve MDT coverage in the municipalities of Carauari and Jurua, on the banks of the River Jurua. While coverage is almost 100% for towndwellers, in the countryside it falls below 50%. The project manager proposes to use Rural Health Agents who were originally contracted for an anti-cholera campaign. They will be trained to detect new leprosy cases and become involved in case-holding and health education activities. Patients will only need to visit the Town Health Centre for confirmation of diagnosis in doubtful cases and for treatment of complications; this should help to ensure the sustainability of project activities. The budget needed is US$ 20,000, half of which has been contributed by the German Leprosy Relief Association (GLRA). Up to June 1995, 13 rural health agents from Jurua and 21 from Carauari had been trained; skin examinations had been performed on 900 individuals and six new cases were detected.

In Eastern Chad, the SAPEL proposal aims to improve MDT coverage through community involvement among leprosy patients belonging to nomadic tribes who are constantly on the move. The leprosy prevalence rate is about 11 per 10,000 population, and it is difficult to maintain high compliance; among the nomads, patients rarely continue treatment beyond three doses of MDT.

The target population consists of three nomadic tribes numbering about 100,000 people; completing treatment of between 250 and 300 leprosy patients will depend on knowing precisely the seasonal movements of these tribes. Resource persons among clan leaders will be selected and trained to spot suspect cases and to deliver MDT. The results will be monitored using three indicators; specificity of diagnosis, clinical improvement and regularity of treatment. A budget of US$ 12,720 has been approved for a period of 12 months. In June 1995, a well-trained team from the national programme went to the area to organize case-finding and select resource persons from the nomadic community. Altogether 115 individuals were examined during the first round of activities before the rainy season started, but no case of leprosy was detected. Provided the end-results are good, this project could be a trendsetter for problems faced by other Sahelian nomadic populations.

Disability: a residual problem

Need for treatment, rehabilitation—and changed attitudes

The ostracism that leprosy patients face is likely to be overcome only slowly, as communities realize that former leprosy patients living among them have been totally cured and cannot transmit the disease to others. But residual impairments—including serious disfigurement—will remain; the lack of sensation will leave cured patients still at risk of injury from heat or other hazards, and they will continue to have difficulty in walking, working and living everyday lives. Ways have to be found of ensuring that such problems and residual deformities do not inhibit people from accepting them as 'fully paid-up' members of the community. So far from deserving ostracism, the cured leprosy patients will need and deserve care and rehabilitation for years to come.

It was the dread of those deformities that caused people to shun leprosy sufferers in the first place, but today a change of mind is needed. Formal health education can help to bring about such a change, while informal methods of education might include group discussions involving disabled leprosy patients themselves, their families and opinion leaders (school teachers, religious leaders, village elders). Once understanding replaces fear and stigma about the physical and social handicaps, a major step will have been taken towards generating supportive measures to efface the old image of leprosy. Of course, no statistics can convey the true disability that stems from social rejection.

WHO's *Weekly Epidemiological Record* of 22 September 1995 (No. 38, 1995, 70, 269–276) contains a study entitled 'Leprosy disabilities: magnitude of the problem,' which attempts to estimate the global burden of disability, and the impact on that burden of control programmes based on MDT. The latest available information shows that the number of cases presenting with disabilities at the time of detection is 39,962 (7·3%) out of 549,672 cases diagnosed in the world; 95% of these cases are reported from the 15 major endemic countries.

MDT interventions have had a tremendous impact on the prevalence of the disease and consequently on disabilities suffered by patients. The overall incidence of impairment is rapidly being reduced because MDT shortens the duration of the disease and limits the incidence and seriousness of leprosy reactions. This reduction is also helped by the leprosy workers' regular monthly contacts with patients, and their improved monitoring and treatment of complications. A key factor is, of course, for new cases of leprosy to be identified and treated as early as possible.

The WHO study concludes that, since MDT was introduced in 1982, about 6·7 million patients have been cured with MDT. This includes about 2·5 million old cases and some 4·2 million new cases detected during the last 12 years. Assuming that 10% to 30% of them already presented disabilities before starting treatment, it can be estimated that MDT intervention has so far prevented between one and two million persons from suffering new disabilities attributable to leprosy.

(*Lep News*, December 1995)

TB: now the world's leading killer of HIV-positive people. WHO, 1995

In WHO Press Release, No. 43, June 1995 under the heading 'Medical Community ill-prepared to cope with rising threat' TB is given as the main killer of HIV-positive people:

Tuberculosis is the leading killer of HIV-positive individuals on a global scale. Health programmes are currently ill-prepared to tackle the crisis. In response, a special meeting of AIDS and TB research experts was convened this week by the World Health Organization's Global Tuberculosis Programme to identify the most relevant research and action to improve TB control in areas where HIV infection is prevalent or increasing.

'The HIV/TB dual epidemic is undermining efforts to control TB,' warned Dr Arata Kochi, Director of WHO's Global TB Programme.' As the incidence of HIV rises in Asia, tuberculosis

will take a deadly toll on those dually infected, killing almost one-third of HIV-positive people, and infecting many of their contacts with TB including those who are HIV-negative. Appropriate research and action are urgently needed to tackle this problem.'

The Global Tuberculosis Programme, in cooperation with the Global Programme on AIDS, is mobilizing medical experts from industrial and low-income countries to develop a new HIV/TB research strategy. This strategy will seek to improve TB control programmes already disabled by growing HIV prevalence and to prevent devastation of TB programmes in countries with a newly emergent HIV problem. The new Joint UN Programme on AIDS (UNAIDS), which will become operational in January 1996, intends to further cooperate with the Global TB Programme.

By the end of the decade, around one-third of all deaths among HIV-positive people will result from TB, according to Global TB Programme estimates. In Abidjan, for example, 32 percent of AIDS cases were considered to have died from TB. HIV is now spreading most rapidly in Asia where TB infection is even more widespread than in Africa.

'The co-epidemic complicates efforts to care for AIDS patients and to identify and treat TB patients,' said Dr Anthony Harries, a physician at Queen Elizabeth Central Hospital in Blantyre, Malawi. 'Health workers are having to deal with ever-increasing caseloads of patients with HIV and TB, and are struggling to manage their programmes while limited by a shortage of manpower and funds, and hampered by a lack of appropriate technology.'

TB germs are transmitted through the air, spreading from person-to-person through coughing, sneezing or even talking. As the disease progresses it is characterized by fever, weight loss and violent coughing which effectively disperses the bacteria to infect surrounding individuals. People who are HIV-positive are probably more likely to be infected with TB than people who are HIV-negative when inhaling TB germs. And people who are co-infected with TB and HIV are 30 times more likely to become sick with TB than people infected only with TB. Because increased HIV cases result in increased cases of infectious TB, larger numbers of people will carry and spread this germ to previously healthy populations. Additionally, the presence of HIV also makes diagnosis of TB much more difficult. People who are HIV-positive often falsely test negative for TB, even though they are ill with the disease.

'As a result of past neglect, TB has already spiralled out of control,' said Dr Paul Nunn, Chief of Research for the WHO Global TB Programme. 'But today, fuelled by the HIV epidemic, TB represents an even larger menace. That is why it is vital that today's narrow TB research agenda be broadened to reflect the complications caused by HIV/TB infection.'

Nunn believes that around the world much current research does not come close to reflecting today's priorities. 'Money is being wasted on projects that will be neither practical nor effective,' he said. 'There is widespread misallocation as well as underfunding. For example, donors have continued to fund narrowly-defined biomedical research that will simply be too costly to be practical in battling the HIV/TB co-epidemic.'

To address this situation, the Global TB Programme is seeking a new partnership with leading scientists and academics from the TB and AIDS communities to help communicate these priorities to leading agencies.

'It is vital that TB and HIV programmes work together in research efforts. This interaction would greatly benefit everyone involved,' said Dr Hans Moerkerk of the Netherlands' Ministry of Welfare and Chairperson for the WHO research meeting.

The group agreed upon a set of the most pressing research needs surrounding the HIV/TB co-epidemic. These are to: 1 improve diagnosis and treatment of TB in HIV-infected individuals; 2 assess the role of and need for preventive TB therapy for vulnerable populations; 3 research coordination and integration of TB services with HIV services at the district level in areas of high HIV prevalence, including emphasis on the role of the private sector; 4 explore the barriers which impede TB patients from seeking and continuing care in high HIV prevalence areas; and 5, conduct a critical study of current expenditures for TB control in communities badly effected by HIV.

'These research priorities will hopefully help us avoid an even worse TB catastrophe in the future,' said Dr Kochi. 'We already know that directly observed treatment, short-course (DOTS) cures TB,' he continued. 'DOTS is inexpensive, and it works. But the numerous barriers to proper treatment of HIV-positive people must be addressed.'

Consensus existed in the group that there is still limited time to take action. With correct research priorities, progress can be made towards lessening the devastating impact of the HIV/TB co-epidemic, especially in Asia where the problem is multiplying.

For further information, contact Mr Kraig Klaudt, WHO Global TB Programme, Geneva, telephone (4122) 791 4627.

Leprosy disabilities: magnitude of the problem, September 1995, WHO

The September 1995 issue of *Weekly Epidemiological Record* (*Relève Epidémiologique Hebdomadaire*), **70,** 269–76, reviews the subject of disability in leprosy in considerable detail. The opening paragraph reads as follows:

Leprosy is considered to be a public health problem and is feared by the community because it is known to produce impairments such as deformities which very often lead to the handicap of social ostracism. Programmes for the control and subsequently for the elimination of leprosy are directed towards reducing these consequences of the disease to very low levels, so that the number of individuals with disabilities as a result of leprosy will be negligible. Most of the experts believe that the best strategy for preventing the long-term consequences of leprosy such as disabilities lies in detecting the disease at an early stage and treating it adequately with multidrug therapy (MDT). However, a number of individuals present with residual disabilities and thus encounter handicap because of past leprosy. Most control programmes do not maintain or possess information on these patients.

The purpose of this article is to review the available information on disabilities due to leprosy and to estimate the overall importance of such disabilities and the likely impact of control programmes based on MDT. These estimates could be used to set priorities and planning of essential activities aiming at preventing the occurrence of disabilities in the community.

The following sections cover: definition and measurement of disabilities related to leprosy; WHO grading of disabilities due to leprosy; WHO International Classification of Impairments, Disabilities and Handicaps; magnitude of the problem (prevalence, incidence, MDT intervention); current situation; estimated global prevalence using various methods; actual proportion of newly-detected cases presenting with disabilities and incidence rates published from various studies.

The Discussion and Conclusions are as follows:

Discussion

Both approaches tend to estimate that the prevalence of individuals living with visible disabilities due to leprosy ranges between 1 and 2 million. The reduction in the incidence of disabilities can be explained by the efficacy of drugs, the reduction in the duration of the disease, the reduction in incidence of lepra reactions, and by operational factors such as improvement in early detection and management of cases.

Only visible physical disabilities have been considered here. Temporary physical disabilities before and during treatment, reactions and complications, and the inconvenience of sustaining long-duration treatment, should all be considered in order to estimate the impact. Moreover, among all infectious diseases, leprosy has a specific cultural connotation and it is difficult to assess the individual social and psychological impact it causes.

Estimates based on information collected from the field through control programmes are often

questioned. It is clear that the sensitivity, specificity and completeness of information collected should be evaluated. On the other hand, applying rates collected from scientific studies conducted in limited places to a theoretical 'population at risk' of leprosy is also likely to lead to over-estimates. Moreover, information on the incidence of disabilities without intervention and before, during and after treatment is very limited. It is expected that the combination of methods described in this article will give some idea of the complexity of the problem, and will stimulate further work on the collection of reliable data relating to the incidence of disabilities.

Conclusions

Since the introduction of MDT in 1982, about 6·7 million patients have been cured with MDT; this includes about 2·5 million old cases (backlog) and about 4·2 million new cases detected during the last 12 years. Assuming that 10% to 30% of them already presented disabilities before starting treatment, one could estimate that MDT intervention has so far prevented between 1 and 2 million persons from suffering new disabilities attributable to leprosy.

A list of references is available on request from the Action Programme for the Elimination of Leprosy, World Health Organization, CH-1211 Geneva 27.

WHO: The Model List of Essential Drugs and Estimating Drug Requirements

Model List of Essential Drugs (Seventh List). Fifth Report of the WHO Expert Committee

Presents and explains the seventh model list of essential drugs issued by WHO as part of its efforts to extend the benefits of modern drugs to the world's population. Intended to guide the selection of drugs in countries where the need is great and the resources are small, the list identifies a core group of prophylactic and therapeutic substances judged capable of meeting the vast majority of health needs and thus deserving priority in purchasing decisions and procurement schemes.

The first part of the report provides updated information on several components of national drug policy necessary to assure that essential drugs, corresponding to essential health needs, are available at all times in adequate amounts and in the proper dosage. The seventh WHO model list of essential drugs is then presented, together with an explanation of changes made when revising the list. Organized according to therapeutic group, the list includes information on route of administration, dosage forms, and strengths for each of 286 essential drugs. For the first time, the list includes a selection of essential drugs needed for the palliative care of cancer patients. A final section presents guiding principles intended to help small national drug regulatory authorities develop a system of legislative and administrative procedures that can assure quality, efficacy and safety, even when resources are limited.

Technical Report Series, No. 825, 1992, 76 pp, ISBN 92 4 120825 2. Sw.Fr 10/US $9·00. In developing countries: Sw.fr 7. Order No. 1100825.

Estimating drug requirements

A task-oriented manual covering the full range of decisions, procedures, and calculations needed to formulate accurate estimates of drug requirements at national or regional levels. Designed for use in courses or for self-tuition, the book uses texts, tables, examples, and exercises to help readers learn how to acquire data on the actual or projected use of health services and then use these data to calculate requirements for each essential drug or vaccine.

The manual consists of eight training modules presented in three main parts. Modules in the first part are intended to help readers understand the evaluations and decisions that must be made before quantification can begin. The second part provides a step-by-step explanation of the patient morbidity-standard treatment method of quantification. Modules provide illustrative standard

drug treatment schedules for quantification based on average doses, an explanation of methods for data acquisition, and full details on calculation procedures. Similar information is then presented for the adjusted consumption method.

Document issued by the WHO Programme on Essential Drugs and Vaccines, 1988, 136 pp. Sw.fr 15; US $13·50. In developing countries: Sw.fr 10·50. Order No. 1930006.

Apply: WHO Publications, Distribution and Sales, 1211 Geneva 27, Switzerland.

Lepr Rev (1995) **67,** 162–168

News and Notes

New initiative in research vacancies

Recipients of research funding who need to recruit individuals for work in biomedical research will now find their task easier thanks to the creation of a powerful new database. The Biomedical Research Assistant Vacancies Database was launched on 10th July by the Wellcome Centre for Medical Science and will be widely available to all users of the Internet and the Joint Academic Network (JANET).

VACANCIES FOR ALL

The new database is the latest addition to the popular WISDOM (Wellcome Information Service Databases on Medicine) service which was launched in January 1995. Information on UK vacancies for graduate, postgraduate and postdoctoral research assistants, technicians on fixed-term contracts and PhD studentships will be supplied via electronic mail by grant holders at academic organisations. The details of the vacancy will include the subject areas, qualifications required, salary and location. It will be possible to specify searches of the database by these and other criteria.

POWERFUL SEARCH INTERFACE

The recruitment process, for both employers and employees, currently relies on advertisements in a variety of mainly print media or Internet bulletin boards. John Cox, Head of the Wellcome Centre's Information Service said, 'This new database overcomes the rather scattered approach to publicising vacancies and Internet access complements existing media. The collection of information in one database and the provision of a powerful search interface will offer significant benefits to all those involved in biomedicine'.

SUPPORTING BIOMEDICAL RESEARCH

This new initiative by the Wellcome Centre furthers its support to the biomedical research community. The Research Assistant Vacancies Database joins the existing WISDOM databases on sources of biomedical research funding, science policy news and a catalogue of more than 5,000 publications held by the Information Service. To access the Vacancies database or any other WISDOM database connect to JANET or the Internet and

- type the command telnet wisdom.wellcome.ac.uk and
- at the login prompt type wisdom

For further information, including a leaflet with details of how to submit details of vacancies, please contact: Information Service Enquiry Desk. Tel: 0171-611 8722; Fax: 0171-611 8726; E-mail: infoserv@wellcome.ac.uk.

Source: *AMRC Newsletter,* September 1995, pp 3–4.

WHO Report of the first meeting of the Leprosy Elimination Advisory Group (LEAG) Geneva, 1995

The meeting was opened on behalf of the Director-General by Dr R.H. Henderson, Assistant Director-General. In his opening speech, Dr Henderson re-affirmed WHO's commitment to achieving the objective of eliminating leprosy as a public health problem by the year 2000. He outlined the important achievements made so far, especially reaching a global MDT coverage of over 75% and with the possibility of raising this to 90% by the end of 1995.

Dr Henderson extended the gratitude of WHO to the Sasakawa Foundation for their contribution to making MDT available for all patients in the world. This, coupled with the political commitment so far achieved, makes it necessary for leprosy control programmes to try to achieve the maximum possible impact now. LEAG, whose membership is drawn from areas covering 80-90% of the global leprosy problem, has a crucial role to play in ensuring the achievement of the elimination target.

Professor M.F. Lechat, Chairman of LEAG, made a quick review of the terms of reference of the group - finally summarizing them as the task of evaluating the past, moderating the present and preparing for the future. He also reviewed the events leading to the formation of LEAG as a replacement for the Leprosy Working Group, and challenged the members to devise strategies to stimulate interest in programmes for the elimination of leprosy in order to counteract any relaxation of efforts and loss of interest, even before the elimination goal is fully achieved.

Professor Lechat singled out the successful implementation of MDT as an important factor in justifying the setting of the elimination strategy. He thanked the Sasakawa Foundation for their commitment to finance the remaining MDT drug requirements.

Dr S.K. Noordeen, Director of WHO's Action Programme for the Elimination of Leprosy (LEP), made a brief outline of the programme structure as modified after the setting up of LEP in December 1994. It now consists of the following components apart from the office of the Director for overall management: (a) country support and special action projects (CSP); (b) monitoring and evaluation of elimination (MEE); (c) capacity building and health systems research (CBH). The main objective of the programme is to eliminate leprosy as a public health problem by the year 2000.

The current global burden of leprosy was summarized in the following indicators:
estimated cases of leprosy, 1.8 million (decrease of 67% compared to 5.5 million in 1991;
number of registered cases, 1.3 million, representing a global prevalence of registered cases of 2.3 per 10,000;
number of cases detected in 1994: 560,000, representing a case detection rate of 10 per 100,000 inhabitants;
disabled individuals, estimated to be between one and two million; and
number of endemic countries, 72 (the top six of these contribute 84% of the global leprosy burden, while the top 19 contribute 92%).

The top six endemic countries are: India, Brazil, Bangladesh, Indonesia, Myanmar, and Nigeria.

The following are some of the indicators of the progress towards implementation of the programme:
the number of people cured after MDT, 6.7 million;
people currently on MDT, 990,000; and
current MDT coverage, 75% (was 50% at the end of 1993): members were cautioned about the interpretation of these data as the patients on MDT are only patients who have been registered and who have received MDT at least once.
It is intended that all countries reach close to 100% MDT coverage by the end of 1995; this is an important prerequisite for the achievement of the elimination target.

Dr Noordeen also discussed data showing the improved MDT coverage in the different WHO regions, with associated decrease in prevalence rates. The available data on disabilities suggest that

widespread use of MDT has led to a significant decrease in the number of disabled patients. The difficulties being faced by the programme include:
dealing with the difficult-to-access areas and populations;
dealing with highly endemic areas—some with a heavy burden now and a high detection. It is still hard to extrapolate incidence from detection as it seems that only a small proportion of newly-detected cases are truly incident cases;
difficulties in maintaining commitment, both political and professional, and the supply of resources; and maintaining sustainability and expertise.

The conclusions and recommendations were as follows:

The Leprosy Elimination Advisory Group (LEAG) reviewed the progress being made towards the elimination of leprosy through the implementation of multidrug therapy (MDT) at the global and regional levels. The Group was encouraged by the steady improvement in the global leprosy situation. However, it expressed its concern with regard to the relatively slow progress in a few countries as it appeared from the reports submitted. While the elimination goal aims at a prevalence below 1 case per 10,000 population, countries should aim at reaching this target at national and sub-national levels.

Since late detection of cases remains a problem in a number of countries and MDT implementation appears to be slow in some places, the Group recommended developing in those places special reinforcing campaign approaches based on specifically targeted activities, which however would not be a substitute for current approaches through the general health services.

The LEAG considered that the task forces on Capacity Building and Health Systems Research (CBH) and on Monitoring and Evaluation of Elimination of Leprosy (MEE) and the steering committee on Special Action Projects (SAPEL) are appropriate for reviewing the situation and taking appropriate decisions.

The LEAG supported the further expansion and continuation of the management training modules, which have contributed greatly to improving leprosy services in many endemic countries. It recommended that leprosy be included in the curricula of medical schools and other schools for health professionals, especially through the development and provision of task-oriented learning materials appropriate for different levels. It also recommended that Health Systems Research (HSR) be used as an important component in capacity building, but from the lessons learnt it was clear that HSR should be oriented to problem-solving at the local level.

Essential Indicators for Monitoring and Evaluating elimination identified earlier are sufficiently reliable and should continue to be limited to six; it is important that they be analysed at sub-national level. The LEAG recommended that additional indicators, namely incidence, disability, relapse and defaulting, be monitored in selected projects.

SAPEL is a welcome innovative approach to addressing special situations and difficult-to-reach patients which cannot be quickly dealt with through the routine health services. It is recommended that this initiative should develop in close collaboration with all possible partners.

The LEAG welcomed and endorsed WHO's Guide to Eliminating Leprosy as a Public Health Problem as a timely publication, and strongly recommended its widespread distribution.

Early treatment with MDT is the most effective way of preventing disabilities. The WHO gradings of disability are useful for monitoring early detection, and there is a need for new approaches to assessing disabilities and handicaps due to leprosy. Simple and cost-effective action for the prevention of disability by patients, health staff and communities should be promoted and complemented.

Current research confirms the efficacy of WHO fixed-duration MDT. It is important to ensure adequate supply and distribution of the MDT drugs, which have been made possible through the generous support from the Sasakawa Foundation.

The LEAG emphasized that the present window of opportunity resulting from global political commitment, the provision of financial support for drugs and the scientific and technological

breakthrough should not be lost. However, it should not be overlooked that elimination as a public health problem has not yet been achieved and further intensive efforts are needed. There is a risk of relaxing the required efforts, and steps must be taken to maintain the momentum at all levels, in close collaboration with different partners. The Group emphasized that, in the later phase of elimination, leprosy expertise must continue to be maintained at appropriate levels.

The group recommended that, in view of the important need for sharing experiences, reinforcing commitment, reviewing progress and maintaining momentum towards elimination, the next International Conference on the Elimination of Leprosy should be organized before the end of 1996 as a follow-up to the Hanoi Conference of 1994.

Document reference: WHO/LEP/95.2. Action Programme for the Elimination of Leprosy, WHO, 1211 Geneva 27 Switzerland

Fifth Independent Evaluation of the National Leprosy Eradication Programme, India

The Fifth Independent Evaluation of the NLEP in India took place, 5–14 June 1995, beginning with a meeting at the Directorate of Health Services, Ministry of Health and Family Welfare, Nirman Bhavan, New Delhi, at which Dr B.N. Mittal, Deputy Director General (Leprosy and Tuberculosis) welcomed all participants, stressing the crucial importance of the event in view of the limited time remaining before the year 2000 and the target of elimination.

Eleven teams, each of 4 members, were assigned to states in various parts of the country, covering districts previously classed as of low, medium and high endemicity. The majority of participants were from India, assisted by the following as temporary advisers to WHO (SEARO) - Dr Yasin Al-Qubati, Yemen Republic; Dr M. Cabanos, Philippines; Dr F. Gakaitangou, N'Jamena; Dr Sissay Befikadu, Ethiopia; Dr Mohsen Labib Abdee-Meguid Zaghlol, Egypt; Dr M. Virmond, Brazil; Dr (Mrs) T.O. Sofola, Nigeria; Dr A.C. McDougall, United Kingdom. The terms of reference called for attention to: 1) a comparative analysis of the leprosy problem in 1985, versus that observed in 1995, with particular reference to disease endemicity by districts, estimated and registered cases, severity of disease and disabilities, 2) a review of the NLEP implementation status at all levels, with emphasis on logistic support, adequacy of resources, administrative support, health education, effective supervision and the identification of critical areas in need of strengthening, 3) a review of current State/Union Territory programme strategies, action plans and future projections in relation to those already formulated at national level, 4) a review of existing infrastructural facilities in terms of adequacy, efficiency and training status, 5) a critical study of reporting and review systems in order to strengthen them, where necessary, 6) validation of reported data, and 7) suggested areas needing special attention, with particular reference to prevalence reduction/trends, plan implementation, programme strategies, acceleration of goal attainment and resource gaps.

Detailed questionnaires were issued to each team covering the information to be obtained by observation and interview from state and district leprosy officers, non-medical supervisors, paramedical workers, physiotherapy technicians, laboratory technicians, patients and members of the general public. Braving exceptional heat, (temperatures of 47 or more were recorded in New Delhi and many other parts of the country during the Evaluation), the teams dispersed to various parts of the country to obtain information, assess performance, interview NLEP staff at all levels, examine registers, case notes and routine reports. On re-assembly in New Delhi on 14 June 1995, each team leader gave a brief summary of the main findings and submitted a detailed report to the Directorate for publication at a later date.

India (1995 estimated population 917 million) has 952,000 estimated cases of leprosy; 740,000 registered, with a registered prevalence rate of 8 per 10,000; 614,000 cases under MDT; an annual case detection rate of 412,000 of which 27,000 have grade 2 disability; a multi-bacillary (MB) rate of 30% and a child rate of 19% in new cases. Between 1983 and 1994, 8.6 million cases of leprosy have been released from treatment in India, including 5.7 million treated with MDT.

Workshop on Health Education and Training Material in View of the Eradication of Leprosy Target by 2000

The aim of the above workshop, held at the Acworth Leprosy Hospital in 1995, was to make available to all in the leprosy field the experience of senior leprosy workers in Bombay. They presented their training and health education material, and, as was expected, through discussion some novel ideas and new material were generated to help others understand and help the strategy of leprosy eradication by the year 2000.

The main speakers were: Dr W. S. Bhatki, Dr V. V. Pai, Dr R. Ganapati, Mr A. Anthony Samy and Dr (Mrs) R. S. Taranekar.

It was decided to collate all the material presented at the Workshop and publish it in booklet form. Acworth Leprosy Hospital, Wadala, Bombay 400 031, India

Leprosy Workers' Conference of Karnataka State, India

Dr M. S. Nilakanta Rao kindly sent the following report:

The first ever conference of State Level Workers organized by the Karnataka State Anti-Leprosy Council in Coordination with the State Directorate of Health Services was held in Bangalore on 11 and 12 November 1995. About 550 delegates, mostly paramedical staff attended.

During the two days 'Core Problems of Leprosy' like 'Persistent new cases cropping up in spite of MDT for 15 years'. 'Problems in Leprosy Control Work', 'Silent Neuritis', 'Persistent Stigma and Consequence Dehabilitation', 'Fixed Duration Therapy' etc. were presented by learned speakers from different parts of India. The delegates were glad to hear the subjects presented by experts like Dr Fritschi, Dr Ganapati, Dr Dharmashakti, Dr Macaden, Sr Mascarenhas, Professor Satish and have enough time for discussion.

The Minister for Health announced that the Cabinet had decided that land would be provided to build a Research Institute on the lines of the Chengalpattu Research Institute.

The Council recommends that such conferences should be held once in 12–18 months, to provide a platform for interaction between workers (themselves) and the State authorities.
Karnataka State Anti-Leprosy Council, Bangalore Baptist Hospital, Bellary Road, Hebbal, Bangalore 560 024, India.

Changing Concepts in Leprosy Treatment

Following a presentation on the subject of '**Newer drugs in Leprosy'** by Dr Ratna, Dermatology lecturer of the LTM Medical College (LTMMC), Sion, a lively discussion among health officials, clinicians, paramedical professionals etc. on the strategies needed to re-orient the medical profession, particularly dermatologists, on modern short-course chemotherapy. The occasion was an academic meeting organized by the Research Society of Acworth Municipal Leprosy Hospital on 15 October 1995 as a part of the Society's 25th year celebrations.

The crucial role of the newly-formed Maharashtra Branch of the Indian Association of Leprologists in undertaking this challenging task was stressed by Dr R. Ganapati, Director, Bombay Leprosy Project. Dr (Mrs) P.R. Vaidya, Dean, LTMMC, the chief guest pointed out that the excellent role model existing in the College for updating postgraduate students and staff effectively in recent advancements in chemotherapy of leprosy should be replicated.

Bombay Leprosy Project enters twentieth year of research work

Dr A. R. K. Pillai, President, Indian Leprosy Foundation who was the Chief Guest of the 19th Anniversary function of the Bombay Leprosy Project (BLP) on 6 October 1995 applauded the

assistance offered by the Project to the National Leprosy Eradication Programme through its outstanding research contributions over two decades. He recalled the difficult teething period in the initiation of the Project's work which has culminated in offering a novel path for 'low cost medical and disability management of leprosy'.

Dr C. R. Revankar, Deputy Director of BLP exhorted the large gathering of project staff to dedicate itself to the proposed TB work in future which has been taken on, as a policy decision, in view of the decline in the leprosy caseload as a result of dedicated work by the staff.

Dr R. Ganapati, Director, BLP who had to attend a crucial meeting of Bombay Municial Corporation and World Bank authorities in order to champion the credibility of the Project to take up TB work in the largest slum in Asia, namely Dharavi, and thereby offer security to the staff, announced that the Project will bring out a publication of its contributions over two decades on the 20th Anniversary October 1996.

Nepal: Technical Supervisors for Leprosy/TB/STD

ILEP *Flash*, Issue 4/95 (International Federation of Anti-Leprosy Associations, 234 Blythe Road, London W14 0HJ) reports the development in Nepal of a new type of health worker with responsibility for leprosy, tuberculosis and sexually-transmitted diseases, replacing the previous District Leprosy Supervisor. The Leprosy Mission has been requested to provide 15 additional supervisors who will give practical help and advice at district level. It is hoped that this collaboration between ILEP members and the Government will strengthen the national programme, including the distribution of multiple drug therapy to all cases in need.

Harnessing the strengths of the leprosy programme to control tuberculosis *BMJ, 1995*

Dr Diana Lockwood (Hospital for Tropical Diseases, London) and Dr Paul Sanderson (Director, Leprosy and Tuberculosis Control Programme, ALERT, Addis Ababa, Ethiopia) contribute an interesting letter to the *British Medical Journal*, 1995, **311,** 862–3, describing potential benefits from a joint programme in Ethiopia. The summary reads as follows:

Tuberculosis remains a leading cause of death in Ethiopia but there is no effective national tuberculosis control programme. By contrast, the leprosy control programme has been very successful, with a 10-fold reduction in the number of leprosy cases requiring antibacterial treatment, though patients with nerve damage require continuing care. The paradox of rising numbers of tuberculosis cases and declining numbers of leprosy cases may be solved by joint leprosy–tuberculosis clinics. The strengths of leprosy fieldworkers in control management, case holding, and compliance can be harnessed in developing an effective tuberculosis control programme. Implementing a joint programme in Ethiopia may be beneficial not only for tuberculosis patients but also for leprosy patients, who are thus brought closer to general medical services.

Handbook of Leprosy, W. H. Jopling and A. C. McDougall, 5th revised edition

The above extensively revised edition (182pp, paperback) has been produced in India and costs Rs 195 per copy. It is available from CBS Publishers & Distributors, 4596/1-A, 11-Daryaganj New Delhi 110002, India. (Phone ND 3276712 or 3271632. Fax 91-11-3276712). CBS previously reprinted the 4th edition and distributed 2000 copies in India, covering many medical colleges, departments of dermatology, units of the *National Leprosy Eradication Programme* and private practitioners.

International Gandhi Award, 1996, Jean Watson

Bombay Leprosy Project (BLP) had the proud privilege of honouring the recipient of the International Gandhi Award for 1996 Ms Jean Watson, an eminent physiotherapist, from the UK on 3 February 1996.

Dr Ganapati, Director of BLP while introducing this recipient said that recognition of the monumental contribution of Ms Watson is a turning point in the history of our march towards the goal of total eradication of leprosy which includes the important component of physical care of leprosy afflicted due to nerve damage besides implementing strategies governing the arrest of the transmission of the disease. However consensus on policies in respect of field care of patients is yet to be evolved in the country.

Dr A. R. K. Pillai, President of Indian Leprosy Foundation (ILEF) congratulated Dr Watson on behalf of BLP and ILEF and remarked that leprosy workers feel encouraged and proud through such relentless work of Ms Watson in various leprosy endemic countries.

Dr Watson in her thankful reply was appreciative of the innovative work in prevention of disabilities (POD) by BLP and invited debate on controversial points on operational aspects of physical rehabilitation. She felt encouraged by the award conferred on her by the Gandhi Memorial Leprosy Foundation and observed that the struggle by the leprosy workers world over, would continue till the disease is eliminated.

Female Bombay Leprosy Project Worker receives Gandhi Award

Gandhi Memorial Leprosy Foundation (GMLF), Wardha, has announced that Mrs Girija Devikaran, Non-medical Supervisor (NMS), Bombay Leprosy Project will be the recipient of Gayatri Award, 1994–95 for excellent work in the field of leprosy. This annual award, which was instituted by GMLF in 1990 to recognize the merit of trained paramedical field staff of at least 15 years experience, consists Rs. 10,000 as cash and a citation. Mrs Girija received the Award on 1 January 1996 in Wardha.

It is significant that Mrs Girija is the second female field worker of Bombay Leprosy Project to be honoured, the first recipient of Gayatri Award being Mrs Rashmi R. Pai, NMS, in the year 1990–91.

In the context of gender issues relating to leprosy patients as well as workers currently being seriously discussed by leprosy experts all over the world, the fact that female workers are recognized in this manner is a happy augury for the future of leprosy work, with the target year for elimination of the disease in the country being 2000 AD.

Diagnosis and management of reversal reaction—forthcoming poster

With the next issue of *Leprosy Review* there will be an exciting new enclosure: an A3 poster on the Diagnosis and management of reversal reactions. This is the first in a series of four posters covering important areas of management and research in leprosy and will be distributed free to the subscribers of the Journal. Subsequent posters will cover: the immunology of leprosy; prevention of disability; and the management of ENL. We hope that these posters will contain learning points for everyone. We would welcome feedback and comment (to the Editor please) on this series and suggestions for future topics.

We are grateful to the Dr K. L. Alexander Charitable Trust for funding this series of posters.

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.

It is understood that the paper is offered to *Leprosy Review* alone, that it will be subject to editorial revision, and that its copyright becomes the property of LEPRA. Manuscripts should be typewritten, in double spacing, on one side of A4 (297 × 210 mm) paper, with wide margins (4 cm all round). Contributors must send three complete copies of the text, tables and figures. On a separate sheet give the title, short title, name and postal address of the author, together with the name of the institution where the work was done. Abbreviations of titles of journals should follow the list of journals indexed in *Index Medicus*. References to books should include the editor(s), publisher and place of publication. Once manuscripts have been accepted a copy on disk that matches the hard copies exactly would be very much appreciated.

Units and Abbreviations. The Journal recognizes the adoption of the Système International d'Unitès (SI Units) proposed in *Units, Symbols and Abbreviations* (1972) published by the Royal Society of Medicine, 1 Wimpole Street, London W1M 8AE. Abbreviations should only be used for unwieldy names, and only when they occur frequently.

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Leprosy Review is published quarterly (Mar., June, Sept., Dec.) by LEPRA. 1996: Volume 67, 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 in Great Britain by Alden, Oxford, Didcot and Northampton.