

Prevalence of Deformities and Disabilities Among Leprosy Patients in an Endemic Area

Part II. Nerve Involvement in the Limbs¹

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Peripheral nerve involvement is the chief cause of permanent disability in leprosy. The problem of disabilities assumes increasing importance not only in terms of evolving better methods of treatment, correction of deformities and rehabilitation of the disabled, but also with regard to better medical management of patients under antileprosy therapy. Episodes of *erythema nodosum leprosum* are reported to be associated with worsening of the neurological deficit (³). It has been reported that prevalence of disabilities is higher among a treated group of patients when compared with the untreated group (⁶). However, few reports of epidemiological studies on the prevalence rates of disabilities are available (^{1, 6}). The definition of disability used in these prior studies did not clearly differentiate the primary neurological deficits which are directly related to the disease process from the secondary complications, such as trophic ulceration and contractures. Further, the W.H.O. scheme of classification grades physical disabilities without clear distinction of their etiology (²).

An epidemiological study of the pattern and prevalence of disabilities which are clearly defined according to their etiology will be useful in defining their relationship to the primary disease process. Such an assessment survey was undertaken in

Gudiyatham Taluk, South India; the findings of which were presented briefly in an earlier communication (⁴). In this paper the pattern of nerve involvement of the limbs is further described and discussed.

MATERIALS AND METHODS

Patients residing in a geographically contiguous area, approximately one-third of Gudiyatham Taluk, constitute the subjects of this paper. The prevalence of leprosy in this section was 29 per 1,000 population. Of 1,780 patients, 1,721 or 97% could be assessed, these consisted of 716 men, 498 women and 507 children (under 15 years of age). Three hundred forty-three were lepromatous, 1,052 tuberculoid, 155 borderline, 168 indeterminate and 3 were purely neural cases which could not be classified. Each patient was thoroughly examined by qualified physiotherapy technicians under the supervision of the consultant surgeon. A special proforma was devised for this purpose, the details of which have been given in a previous publication (⁵). The functional state of each of the peripheral motor nerves at risk was examined and graded as normal, partial paralysis or complete paralysis.

The sole criteria for recognition of motor nerve dysfunction was weakness or paralysis of the individual muscles supplied by the nerve. The nerves considered were the ulnar, median, radial, lateral popliteal, and facial. A sample group of muscles supplied by each nerve was tested individually by using the "manual muscle test" and graded 0 to 5 according to the Medical Research Council scale. Patients showing early motor nerve dysfunction, as evidenced by minimal weakness of muscles, were further tested and confirmation made by using

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strength-duration curves and, in certain cases, by electromyography. These cases were included among those with motor paralysis. Posterior tibial nerve paralysis was not included in this survey, as reliable clinical testing of intrinsic function in feet is not possible. Deformities "typical" of a nerve deficit were not considered reliable evidence of nerve dysfunction.

No. 5 nylon was used to test for peripheral anesthesia that occurs independently or concurrently with motor paralysis. Since the acuity of sensation may be impaired in the calloused feet of people who walk barefoot, only those feet which showed definite evidence of past or present plantar ulceration were accepted as having definite proof of loss of sensation.

RESULTS

Of the total of 1,721 assessed, 622 had nerve involvement of limbs and face with or without other disabilities. Of these, 614 had nerve involvement of the limbs only, constituting nearly 36% of the total patients assessed. Nerve involvement of the limbs according to the type of leprosy is shown in Table 1.

Lepromatous and borderline cases were the most affected (nearly two-thirds) as compared to only 23% among tuberculoid and 18% among indeterminate. The differences were highly significant ($P < .01$).

The number of limbs involved varied between one and four in a disabled patient and variations were observed in relation to the type of leprosy, as summarized in Table 2.

While patients with all types of leprosy show multiple limb involvement, there are obvious differences between the lepromatous/borderline cases and the tuberculoid/indeterminate patients. More than 50% of the disabled patients belonging to the lepromatous and borderline type of leprosy had three to four limbs involved. On the other hand, more than 45% of patients with tuberculoid and indeterminate cases with neurological deficit had only one limb involved.

Of the total number of limbs examined among the 1,721 patients, the percentage of limbs with neurological deficit is shown in Figure 1.

The nerve involvement was further

TABLE 1. *Patients with nerve involvement of limbs according to type of leprosy.*

Type of leprosy	Number assessed	Nerve involvement of limbs	
		Number	Percent
Lepromatous	343	244	71.1
Tuberculoid	1052	241	22.9
Borderline	155	97	62.6
Indeterminate	168	30	17.9
Unclassified			
(Purely neural)	3	2	66.7 ^a
Total	1721	614	35.7

^a Based on three cases only.

TABLE 2. *Number of limbs involved in 614 disabled patients of different types of leprosy.*

Type of leprosy	Total patients disabled	Percent of patients in each type with involvement of:			
		one limb	two limbs	three limbs	four limbs
Lepromatous	244	22.1	27.9	21.7	28.3
Tuberculoid	241	47.3	25.7	14.9	12.1
Borderline	97	17.5	30.9	23.7	27.9
Indeterminate	30	46.7	16.7	23.3	13.3
Unclassified	2	100.0	—	—	—
All types	614	32.7	26.9	19.4	21.0

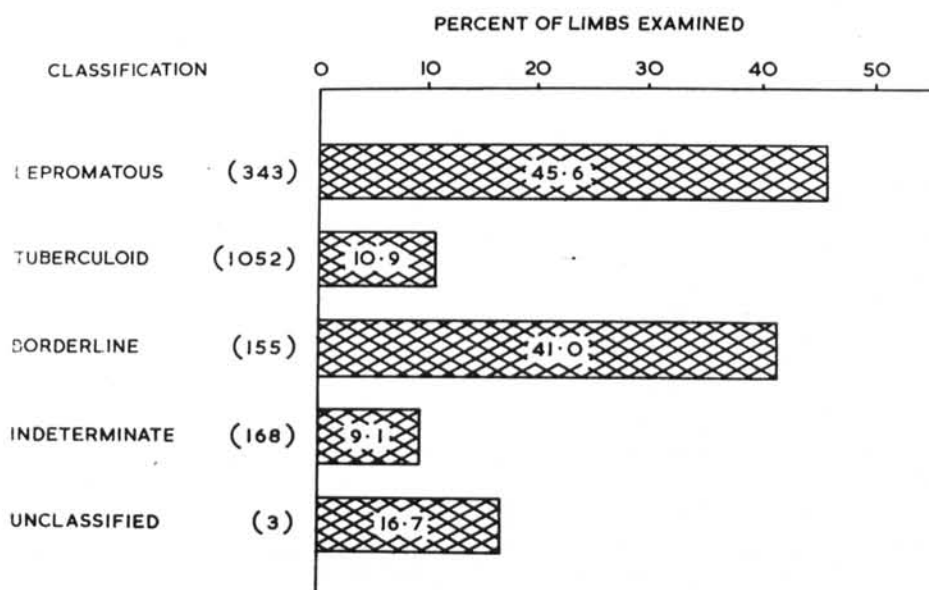


FIG. 1. Neurologic deficit in the limbs. Figures in brackets indicate number of patients examined.

studied in terms of the upper and lower limbs and the findings were as described in Table 3.

While upper limb involvement is seen in 91% of the disabled patients, only 53% of the 614 patients had lower limb involvement. One or both upper limbs, with or without lower limb involvement, seemed to be the most frequent pattern among these patients.

When taken as a single group, 47% of disabled patients had only one or both upper limbs involved. The next common group were those with all four limbs involved. Of the 129 patients with all four

limbs involved, 69 patients (53.3%) had lepromatous leprosy.

In each of the limbs affected, there could be anesthesia alone or combined with motor paralysis due to a peripheral nerve trunk involvement. The findings on this aspect in the 557 patients with upper limb involvement were as shown in Table 4.

In all types of leprosy, among upper limbs that had neurological deficit, 75% had motor nerve paralysis. The frequency of occurrence of paralysis of the various motor nerves in the limbs were as shown in Table 5.

The motor nerve most affected was the

TABLE 3. Involvement of upper and lower limbs among the 614 disabled patients.

Involvement of upper limb	Involvement of lower limb			Total
	Nil	One	Both	
Nil	—	46 7.5%	11 1.8%	57 9.3%
One	155 25.2%	23 3.7%	20 3.3%	198 32.2%
Both	131 21.4%	99 16.1%	129 21.0%	359 58.5%
Total	286 46.6%	168 27.3%	160 26.1%	614 100.0%

TABLE 4. Occurrence of paralysis with anesthesia in 920 disabled upper limbs of 557 patients.

Type of leprosy	Upper limbs involved	Percent with:		Total
		Anesthesia and paralysis	Anesthesia alone	
Lepromatous	400	80.3	19.7	100.0
Tuberculoid	316	84.8	15.2	100.0
Borderline	162	83.3	16.7	100.0
Indeterminate	41	75.6	24.4	100.0
Unclassified	1	100.0	—	100.0

TABLE 5. Details of the motor nerves found paralyzed.

Nerve	Ulnar	Median	Radial	Lateral popliteal	Facial	Total
Number	732	254	8	89	69	1152
	63.5%	22.1%	0.7%	7.7%	6.0%	100.0%

ulnar nerve and the least was the radial nerve. Facial nerve is also shown to make the comparison complete.

DISCUSSION

Estimates on the extent of disability among leprosy patients should be interpreted with due regard to the definitions adopted, criteria employed, and the clinical phase during which the assessments were made. As pointed out earlier, the procedure for recognition of nerve deficit in this study was a careful and thorough examination of the entire surface of the limb with No. 5 nylon for anesthesia, and examination of selected muscles for weakness during voluntary contraction against resistance. Deformities of fingers or joints were not considered as evidence of paralysis. For example, clawing that occurs as a result of ulnar paralysis may be simulated by deep fascial contracture and Landsmeer ligament contracture resulting in flexion deformity of the proximal interphalangeal joint due to local lepromatous infiltration or lepra reaction. On the other hand, paralytic clawing is not evident in fingers where the distal two phalanges are lost. Further, when there is an aberrant median nerve innervation of all the four lumbricals, there may be no clawing in spite of the fact that the ulnar nerve is paralyzed.

It is obvious from this study that there was a much higher percentage of disability among patients with bacillated forms of leprosy (*viz.*, lepromatous and borderline) than among those with the nonbacillated types; the severity of disability among patients with bacillated forms of leprosy was seen not only in terms of percentage of patients disabled but also in terms of number of limbs involved per patient. Borderline and lepromatous types had respectively 41% and 46% of all their limbs involved, while only 10% of limbs of patients with nonbacillated forms were disabled. Among the limbs with neurological deficit, prevalence of anesthesia alone was much less than the prevalence of anesthesia combined with paralysis.

The percentage of upper limb involvement seems very high when compared with those with lower limb involvement. This difference may be partly due to the different criteria of assessment used in recording nerve involvement in the lower limb. However, a further study using electromyography to accurately identify posterior tibial nerve paralysis has revealed a very low prevalence rate of posterior tibial nerve paralysis when compared with the prevalence rates of ulnar or median nerve paralysis (⁴). Thus, there seems to be a definitely higher predilection for the upper

limbs to develop major neurological deficits when compared with the lower limbs.

There was no instance in which there was motor paralysis alone or even early muscle weakness without anesthesia. This may suggest that anesthesia always precedes paralysis when a peripheral nerve trunk is affected in leprosy. Thus, onset or extension of anesthesia over the limb may signify, in some cases, impending motor paralysis. However, extensive and permanent anesthesia of the limb without motor paralysis certainly exists as a clinical entity. The exact percent of the limbs belonging to this category can be determined only by studying representative groups of "disease arrested" cases.

Of the motor nerves paralyzed, 63.5% were ulnar nerves. The median nerve was only a third as common. The rest of the motor nerves were each less than 10% of the total number of involved nerves, the radial being the least common. The reason for the marked predilection of the ulnar nerve for paralysis when compared with other nerves is inadequately understood.

Methods of prevention of the development of neurological deficit among patients under therapy is not clear. Attempts at preventing nerve dysfunction are made among patients presenting acute pain and tenderness of the nerve trunk, commonly known as "neuritis" or a sudden onset of paralysis, which draws the attention of patients or the clinician to the affected nerve. However, in the majority of patients with nerve deficit there is no history of pain in the paralyzed nerve trunk nor a history of sudden onset of paralysis of motor or sensory nerve function. No specific therapy has been found effective in preventing such nerve destruction which occurs and progresses insidiously. Unless each patient is routinely and specifically examined for early neurological deficit, the onset and progression of these serious disabilities are missed by the clinician till paralytic deformities or destructive trophic ulceration in anesthetic limbs have occurred. Identifying those who are at a higher risk for nerve involvement should help the physician in the early diagnosis of the onset of neurological deficit.

The manner of onset and progression of

peripheral nerve dysfunction can only be studied on a prospective basis by periodic assessments of leprosy patients. Such a study would also provide the possibility of identifying the precipitating factors for nerve involvement. Findings in relation to these aspects will be presented in a later communication on the basis of the surveys made on leprosy patients in Gudiyatham Taluk.

SUMMARY

The nerve involvement in the limbs of leprosy patients resident in an endemic area is described and discussed on the basis of a detailed assessment made on 1,712 patients. The functional state of each of the peripheral motor nerves at risk were examined and graded using manual muscle tests and strength duration curves. Electromyographic studies were also carried out in a few cases. No. 5 nylon was used to test peripheral anesthesia. Nearly 36% of the patients had nerve involvement of limbs. There was a significantly higher percentage of disability among patients with bacillated types. The severity in the former was seen not only in terms of the percentage disabled but also with regard to the number of limbs involved per patient. The upper limb involvement was significantly higher as compared to involvement of the lower limb. There was no instance in which there was motor paralysis alone or even early muscle weakness without anesthesia. However, extensive and permanent anesthesia of the limb without motor paralysis was recorded. Ulnar nerves were most affected followed by the median nerve. The implication of these findings are discussed.

RESUMEN

Se describe el compromiso de los nervios de las extremidades de pacientes de lepra que residen en un área endémica y se discute sobre la base de una evaluación detallada realizada en 1,712 pacientes. Se examinó el estado funcional de cada uno de los nervios motores periféricos que estaban bajo riesgo y este estado se calificó utilizando pruebas musculares manuales y curvas de duración de fuerza. En algunos casos se efectuaron también estudios electromiográficos. Como prueba para la anestesia periférica se utilizó nylon N° 5. Alrededor del

36% de los pacientes tenía compromiso de los nervios de las extremidades. Hubo un porcentaje de incapacidad significativamente mayor entre los pacientes con tipos bacilíferos. La gravedad de lo anterior fué observada no solamente en términos del porcentaje de incapacitados, sino también con respecto al número de extremidades comprometidas por paciente. El compromiso de la extremidad superior fué significativamente mayor en comparación con el compromiso de la extremidad inferior. No hubo ningún caso en el cual hubiese solamente parálisis motora o aún debilidad muscular precoz sin anestesia. Sin embargo, se registró anestesia extensa y permanente de la extremidad sin parálisis motora. Los nervios cubitales fueron los más afectados, seguidos por el nervio mediano. Se discuten las implicaciones de estos hallazgos.

RÉSUMÉ

On décrit dans cet article l'atteinte nerveuse au niveau des membres des malades de la lèpre résidant dans une zone endémique. Cette atteinte est discutée sur la base d'une évaluation détaillée menée sur 1.712 malades. L'état fonctionnel de chacun des nerfs moteurs périphériques exposés à des lésions de lèpre, a été examiné et la gravité a été estimée, en utilisant des épreuves musculaires manuelles, ainsi que des courbes portant sur la durée de l'effort. Des études électromyographiques ont été également menées dans quelques cas. Du nylon de calibre 5 a été employé pour étudier l'anesthésie périphérique. Environ 36 pour cent des malades présentaient une atteinte nerveuse au niveau des membres. On a constaté une proportion significativement plus élevée d'invalidité parmi les malades présentant des types bacillaires. Cette gravité ne concernait pas seulement la proportion de personnes atteintes d'invalidité, mais aussi le nombre de membres atteints par malade. L'atteinte des membres supérieurs était significativement plus fréquente que celle des membres inférieurs. On n'a observé aucun cas chez lequel la paralysie motrice, ou même une myasthénie précoce étaient survenues, sans anesthésie simultanée. Par contre, de l'anesthé-

sie étendue et permanente des membres a été observée sans paralysie motrice. Les nerfs cubitiaux étaient les plus souvent atteints; l'atteinte du nerf médian venait ensuite. Les conséquences de ces observations sont discutées.

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