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Title: Grading of Deformities/ Disabilities of limb In Patients With Leprosy: A Cross Sectional Study

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ABTRACT

Background: Among communicable diseases, Leprosy remains a leading cause of peripheral neuropathy and disability worldwide. Disabilities and deformities are of major concern as it triggers social, economic and psychosocial problems of leprosy patients. **Objectives:** To detect deformities and disabilities of limb in leprosy patients and grading them according to WHO deformity and disability grading system (2007). **Materials & Methods:** It was a hospital-based, cross sectional study. One hundred and forty six patients with leprosy attending the Dermatology, Venereology and Leprosy outpatient department were included in the study. All patients were examined for all kinds of deformities of hands, feet and face. Slit skin smear and biopsy was done in all new cases. **Results:** Mean age of patients was 38.1(±15.6) years. The mean duration of disease was 2.6 (±4.1) years. A statistically significant ($p<0.001$) number of patients with deformity presented to hospital by 2 years of onset. Proportion of deformities was greater in males, in farmers and in people belonging to lower socioeconomic status ($p=0.008$). Multibacillary patients had higher rate of deformities of hands and feet and a statistically significant ($p<0.05$) number of MB patients had grade 2 ocular deformity (WHO 2007).

Conclusion: Early identification of disease and deformities can help in educating the patients about leprosy and thus prevention of progression to adverse sequelae.

Keywords: Deformities, Disabilities, Limb, leprosy patients, grading, WHO deformity and disability grading system (2007).

INTRODUCTION: Leprosy is a disabling disease when diagnosed late and left untreated. WHO expert committee on leprosy has recommended in their 6th report that prevention and management of leprosy related impairments and disabilities should be implemented effectively.[1] The best way to prevent disabilities in leprosy is through early detection of patients, early recognition of mild impairments, and provision of appropriate treatment.

Skin lesions of leprosy are variable depending upon the immunological spectrum of the disease. Lesions are large, solitary or multiple but countable in asymmetrical distribution at higher spectrum (TT, BT) whereas small, numerous and symmetrically distributed at lower spectrum of the disease. [2]

Deformities are the loss or abnormality of psychological, physiological or anatomical structure or function. [3] It may be either visible impairments or consequences of invisible impairments. [3] Disability is the inability to perform certain activities, which were normally possible, but become difficult or impossible to carry out because of deformities.[3]

The deformities due to leprosy result in extensive loss of man power and economic loss to the society.[7] Leprosy remains a public health problem in fifty five countries but thirteen countries account for 94% of total registered cases.[8] India, Brazil and Indonesia report more than 10,000 new patients annually. Globally about 21,3899 new cases were detected with Grade 2 deformity corresponding to 6.6% of the total number of newly diagnosed patients and to a rate of 2.5 cases per million (WHO 2015).Various factors seem to determine development of the disease and deformities. As these deformities are recognizable due to leprosy, presence of these result in social stigma. [4,5]

The results of many Indian studies provide a highly variable range of deformities among leprosy patients (9.2% to 50%). [6,7] However, the variables like study location, study population, study period, inclusion criteria etc. are widely different in these studies; hence it is not possible to estimate the accurate epidemiology of leprosy-related deformities and disabilities in the country from these studies. The present study has been planned to assess the burden of deformities and disabilities in leprosy patients and grading them according to WHO deformity and disability grading system (2007) in northern Karnataka in postelimination era.

MATERIALS AND METHODS: This hospital based cross sectional study was conducted in the department of Dermatology Venereology and Leprosy of B.L.D.E.U's Shri. B.M. Patil Medical College Hospital and Research Centre, Vijayapur, Karnataka. One hundred and forty six cases were included in the study. The study duration was from November 2014 to September 2016. Ethical clearance was obtained from the institutional ethical committee for the present study.

Inclusion criteria: All leprosy patients irrespective of age, gender and treatment status were included in the study.

METHOD: Detailed history of the patient was taken in respect to duration of disease and deformity, history of contact, episodes of reactions if any, and treatment. Each patient was subjected to complete cutaneous examination and palpation of peripheral nerves. Presence or absence of deformities were recorded. All patients underwent following steps of clinical examination:

- Detailed inspection of hands, feet, face and eyes for lesions and any visible deformity.
- Examination of peripheral nerves.
- Sensory tests done on hands and feet:
  1) Temperature test with hot and cold water.
  2) Pin prick test
  3) Cotton wool test
  4) Semmes Weinstein monofilament test (SWMT)
- Tests for muscle power:
  1) Hands:

- Pen test (Abductor pollicis, median nerve)
- Card test (Interossei and lumbricals, ulnar nerve)
- Book test (Deep branch of ulnar nerve)
- Extension of wrist against resistance (wrist extensors, radial nerve)
- Beak test (Triple nerve test).

2) Feet:

- Extension of great toe against resistance (Anterior tibial nerve)
- Dorsi-flexion and plantar-flexion of ankle against resistance (Common peroneal nerve)
- Inversion and eversion of foot (Posterior tibial nerve)
- Adduction and abduction of toes against resistance (Medial and lateral branches of tibial nerve)

Type of deformity was noted down from head to toe and grading of deformity was done according to WHO classification of disability measurement proposed in the year 2007.

Statistical Analysis: For continuous variables, the summary statistics of N, mean, standard deviation (SD) were used. For categorical data, the number and percentage were used in the data summaries. Chi-square (χ^2) test was used to determine the significance of differences between groups for categorical data. If the p-value was < 0.05, then the results were considered to be significant. Data were analyzed using SPSS software v.24.0.

RESULTS: Among 146 patients, 85 were males (58.2%) and 61 were females (41.8%). The mean age (± SD) of the study population was 38.1 (±15.6) years. Most prevalent clinical type was borderline tuberculoid leprosy in 54 (37%) patients, followed by lepromatous leprosy in 49 (33.6%), borderline lepromatous in 22 (15.1%), pure neural in 6 (4.1%), tuberculoid and histoid types in 5 (3.4%) patients each, mid-borderline in 3 (2.1%) and indeterminate in 2 (1.4%) patients. Most common type was multibacillary in 133 (91.1%) patients followed by paucibacillary in 13 (8.9%) patients.

Majority of the patients belonged to lower socioeconomic (S-E) status (n=100, 68.5%) followed by middle (n=46, 31.5%). Out of the 146 patients, 110 (75.3%) belonged to rural areas and 36 (24.7%) were from urban areas.

Out of 146 patients, 56 (38.4%) had the disease for 1-2 years, followed by 39 (26.7%) patients, whose disease duration was less than one year. Thirty six (24.7%) patients had the disease for 3-5 years, and 15 (10.3%) patients had disease duration for more than 5 years. Among 146 patients, 41 (28.1%) had type 2 reaction, and 22 (15.1%) had type 1 reaction.

Duration of deformity was less than a year in 90 (61.6%) patients. Twenty eight (19.2%) patients each, had deformities for 1-2 years, and more than 2 years.

In the hands, shortening of fingers was seen in 13 (8.9%) patients, banana fingers were seen in 10 (6.8%) patients, reaction hand in 2 (1.4%) patients and swan neck deformity in 1 (0.7%) patient. In the feet, fixed foot deformity was present in 10 (6.8%) patients, tarsal disorganization was seen in 2 (1.4%) patients. Table 1

Table 1: Distribution of specific deformities of limbs

Specific deformity	No. of patients	Percentage (%)
UPPER LIMB		
Banana Fingers (Fig A)	10	6.8
Reaction hand	2	1.4
Shortening of fingers(Fig B)	13	8.9
Swan neck deformity	1	0.7
LOWER LIMB		
Fixed deformity of toe and feet(Fig C)	10	6.8
Tarsal Disorganization	2	1.4

Distribution of anaesthetic deformities of limbs

In the hands, majority of the patients had xerosis (n=113, 77.4%), followed by trophic ulcer (n=20, 13.7%). Cracks (n=13, 8.9%), fissures (n=2, 1.4%), and other (n=10, 6.8%) deformities were also noted. In the feet, most of the patients had xerosis (n=115, 78.8%). Cracks (n=44, 30.1%) and fissures (n=10, 6.8%) were also noted. Trophic ulcer was present in 26 (17.8%) patients. Table 2

Table 2: Percentage distribution of anaesthetic deformities of limbs

Anaesthetic deformity	No. of patients	Percentage (%)
UPPER LIMB		
Xerosis	113	77.4
Cracks	13	8.9
Fissures	2	1.4
Trophic ulcer(Fig D)	20	13.7
Others	10	6.8
LOWER LIMB		
Xerosis	115	78.8
Cracks(Fig	44	30.1

E)		
Fissures(Fig F)	10	6.8
Trophic ulcer(Fig G)	26	17.8
Others	17	11.6

In the hands, claw hand was the commonest deformity seen in 24 (16.5%) patients, flattening of thenar and hypothenar eminences in 24 (16.4%) patients, guttering in 18 (12.3%) patients. Wartberg's sign was present in 7 (4.8%) patients, ape thumb in 3 (2.1%), wrist drop and Benediction's sign in 1 (0.7%) patient each. In the feet, claw toes was seen in 18 (12.3%) patients, guttering in 15 (10.3%), fanning of toes in 11 (7.5%), collapse of arch in 6 (4.1%), foot drop in 2 (2.7%) patients.

Out of 146 patients, 2 (1.3%) patients had loss of temperature sensation alone in the hands and 3 (2%) patients in the feet. Loss of temperature and cotton wool sensation in the hands was seen in 19 (13%) patients and 17 (11.6%) patients in feet. Sixty three (43.1%) patients had loss of temperature, cotton wool, pin-prick sensation along with impaired sensations as tested by Semmes-Weinsten monofilaments (SWMF) in the hands and , 68 (46.5%) patients in the feet.

Distribution of grade of deformity (hands and feet):

The distribution of deformities of hands and feet have been shown in tables 3 and 4 respectively

Table 3: Percentage distribution of grade of deformity (hands and feet)

Grade of deformity	No. of patients	Percentage (%)
0	49	33.6
1	36	24.7
2	61	41.8
Total	146	100

It is observed that majority of the patients with deformity of hands and feet belonged to lower socio-economic status. The association of deformity and socio-economic status was statistically significant (p=0.008). The association of disease duration with presence of deformities was statistically nonsignificant (p=0.082). However, there was variability in this association. Patients with disease duration of < 1 year had lesser deformities (grade 1: n=6, 15.4%; grade 2: n=12, 30.8%). The number of deformities was maximum in patients with disease duration of 1-2 years, followed by 3-5 years. Patients with disease duration of >5 years

had least occurence of deformities. A statistically significant ($p<0.001$) number of patients with deformity presented to hospital by 2 years of onset. Table 4

Table 4: Level of significance of grade of deformity (hands and feet) with selected parameters

Parameters	Grade 0		Grade 1		Grade 2		p value
Gender	**No. of patients**	**Percentage (%)**	**No. of patients**	**Percentage (%)**	**No. of patients**	**Percentage (%)**	
Male	24	28.2	23	27.1	38	44.7	0.111
Female	25	41.0	13	21.3	23	37.7	
Age group							
5-15	3	60.0	0	0.0	2	40.0	0.611
16-25	13	39.4	7	21.2	13	39.4	
26-40	16	31.4	15	29.4	20	39.2	
41-60	14	33.3	9	21.4	19	45.2	
61-75	2	14.3	5	35.7	7	50.0	
>75	1	100.0	0	0.0	0	0.0	
Occupation							
Daily wage worker	2	25.0	1	12.5	5	62.5	0.401
Driver	3	42.9	1	14.3	3	42.9	
Farmer	11	25.6	13	30.2	19	44.2	
Housewife	10	38.5	5	19.2	11	42.3	
Labourer	3	20.0	3	20.0	9	60.0	
Others	12	42.9	8	28.6	8	28.6	
Student	6	50.0	1	8.3	5	41.7	
Teacher	2	28.6	4	57.1	1	14.3	
S-E status							
Lower	12	37.5	6	18.8	14	43.8	0.008*
Upper Lower	15	22.1	19	27.9	34	50.0	
Lower Middle	12	42.9	7	25.0	9	32.1	
Upper	10	55.6	4	22.2	4	22.2	

Middle							
Duration of deformity in years							
<1	47	52.2	17	18.9	26	28.9	<0.001 *
1-2	1	3.6	10	35.7	17	60.7	
>2	1	3.6	9	32.1	18	64.3	
Duration of disease in years							
<1	21	53.8	6	15.4	12	30.8	0.082
1-2	13	23.2	17	30.4	26	46.4	
3-5	11	30.6	8	22.2	17	47.2	
>5	4	26.7	5	33.3	6	40.0	

*significant at p<0.05

It is observed that association of type 1 reaction was statistically significant (p<0.001) with both grade 1 and grade 2 deformities, whereas this association was not statistically significant for type 2 reaction (p>0.05). Patients with BT, tuberculoid, BB, pure neural and histoid leprosy were statistically significantly associated with grade 2 deformity (p<0.001). In patients with BL, grade 1 deformity was more common and this association was statistically significant (p<0.001). In LL patients grade 2 deformities were more as compared to grade 1, but this association was not statistically significant (p>0.05). Table 5

Table 5: Level of significance of grade of deformity (hands and feet) with types of disease and reaction

Parameters		**Grade 1**		**Grade 2**		**p value**
		No. of patients	**Percentage (%)**	**No. of patients**	**Percentage (%)**	
Reaction	Type 1	10	63	6	38	<0.001*
	Type 2	14	52	13	48	>0.05
Types of disease	Tuberculoid	0	0	1	100	<0.001*
	BT	10	29	25	71	<0.001*
	BB	0	0	2	100	<0.001*
	BL	8	62	5	38	<0.001*
	LL	16	42	22	58	>0.05

	Pure neural	0	0	4	100	<0.001*
	Histoid	1	33	2	67	<0.001*

*significant at p<0.05

It is observed that there was no significant association of deformities of hands and feet with treatment status (p=0.16). Similarly association of deformities of hands and feet with MB or PB disease was not statistically significant (p=0.178).

DISCUSSION: Most common age group affected was 26 to 40 years followed by 41 to 60 years. In a study by Jain *et al* the average age of disease onset was 35.73 years (range 6 to 75 years). [8] Singh *et al* have reported the age range of leprosy patients in their study to be 7 to 80 years (mean 36.5 years). .[7]

Male patients were the common sufferers (M:F=1.3:1). Though male patients had more deformities than females, the association of deformities with gender of patients was not statistically significant (p=0.390). Similarly Kumar *et al* [9] and Jain *et al*.[7] have reported higher occurrence of deformities in male patients as compared to females, among their study subjects (p=<0.0001).

Although leprosy affects both the genders, in most parts of the world males are affected more frequently than females often in the ratio of 2:1. This preponderance of leprosy in males has been observed in countries like India, Philippines, Hawaii, Venezuela and Cameron.[10] Relatively lower prevalence of leprosy among females may be due to environmental or biological factors. Epidemiological characteristics of leprosy appears to be like many other communicable diseases where males are more frequently affected than females. .[11]

More than 91% of the patients belonged to MB group and 9% belonged to PB group. Higher incidence of deformities of hands, feet and eyes was seen in MB cases, and association of ocular deformities with MB disease was statistically significant (p=0.006). Kumar *et al* [9] have reported overall disability rate of 7.9% in their study subjects and among these MB patients had significantly higher disability rate than PB patients (17% *vs.* 3.8%). Chavan *et al* [12] recorded more disability among MB patients (60%) as compared to PB patients (19%). In the study by Jain *et al* [13] majority of the patients belonged to MB group while 131 (43%) were in the PB group. Disability rate was more in MB leprosy patients (11.6%) than in PB (6.9%). Similarly Sarkar *et al* [14] noted that MB patients had significantly higher disability (31.6%) than PB patients (10%). So our study results are similar to the published Indian literature.The association of disease duration with presence of deformities was statistically non-significant (p=0.082). However, there was variability in this association. Patients with disease duration of < 1 year had lesser deformities (grade 1:16.7%; grade 2:19.7%). The number of deformities was maximum among patients with disease duration of 1-2 years, followed by 3-5 years. A statistically significant (p<0.001) number of patients with deformity presented to hospital by 2 years of onset. In a study by Kumar *et al* [9] paralytic deformities were rare in whom duration of disease was less than a year, but increased considerably from 3.9% at 1-3 years to 25% when diagnosed late, i.e >8 years.

In our study 24.7% patients had grade 1 deformity and 41.8% had grade deformity of hands and feet. Sixty one (41.8%) patients had grade 2 deformity of eyes. In a study by Kumar *et al*[9] the overall disability rate was 7.9% and out of 58 patients with grade 2 deformities of hands and feet, 45 (77%) had paralytic deformities. Chavan *et al* [12] recorded grade 2 disability in 13 (12.39%) patients and the disability rate for hands and feet was 38.10 %. Eye disability was not found in any of the patients by these authors. Jain *et al* [13] noted higher prevalence of grade 2 deformity than grade 1. Nine patients (3 %) had grade 1 and 20 patients (6.6%) had grade 2 deformity. In a study by Sukumar *et al* [15] out of 259 patients 22 (8.5 %) had grade 1 and 30 (11.6%) had grade 2 deformities of hands and feet. Sarkar *et al* [14] had detected 49 (20.1%) patients with disabilities among 244 newly diagnosed cases. Among these 28 (11.5%) had grade 1 and 21 (8.6%) had grade 2 disability. Both grade 1 (n=9, 39.1%) and grade 2 (n=5, 21.8%) disability were more among pure neural leprosy patients. BT patients with more than five skin lesions also had more disability than patients with ≤5 lesions. [16] Hence our study results corroborate to that of other studies.

Among 146 patients, 63 had lepra reactions out of which type 1 reaction was present in 22 (15.1%) patients. Association of type 1 reaction was statistically significant ($p<0.001$) with both grade 1 and grade 2 deformities. In a study by Kar *et al* [6] reactions were present in 55(20%) children of which 11 had deformities.In this study, the proportion of cases with anaesthesia (grade I deformity) is 24.7%.

Conclusion: This study lead to recognition of various deformities in the patients ranging from mild impairment of sensory functions to gross mutilation of hands, feet and face. Early detection of anaesthesia in the extremities can help in educating the patients regarding the care of limbs and also to identify risk factors.

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DECLARATIONS

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