

Clinico-epidemiological Study of Disability Due to Leprosy at the Time of Diagnosis among Patients Attending a Tertiary Care Institution

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Abstract

Background: With the declared elimination of leprosy as a public health problem, the World Health Organization has shifted the focus on the disabilities and deformities associated with leprosy. **Aims:** The aim was to study the Grade 1 and Grade 2 disability among newly diagnosed leprosy patients. **Materials and Methods:** All newly diagnosed leprosy patients attending the Outpatient Department of Government Medical College, Kozhikode, from January 1, 2013 to December 31, 2013 were included in the study and the Grade 1 and Grade 2 disabilities observed were analyzed. **Results:** During the 1-year period, 76 patients were diagnosed to have leprosy. Grade 1 and Grade 2 disabilities were noted in 31.6% and 17.1%, respectively. Major factors identified as risk for leprosy disability at the time of diagnosis were age >45 years, >5 skin lesions, ≥ 2 thickened peripheral nerve trunks, pure neuritic and borderline tuberculoid spectra of leprosy. **Limitation:** As the study was conducted in a tertiary care center, it does not perfectly indicate the status in the community. **Conclusion:** Disability noted in nearly 50% of leprosy cases at the time of diagnosis highlights the need to improve the effectivity of existing health-care system in early case detection and timely referral. In addition, it underscores the need to educate the affected regarding protective eye, foot, and hand care, so that progression to Grade 2 disability can be prevented.

KEY WORDS: Grade 1 disability, grade 2 disability, leprosy

Introduction

The WHO introduced a global target of reducing the rate of new cases with Grade 2 disabilities per 100,000 population by at least 35% at the end of 2015 compared to the baseline at the end of 2010. By focusing on interventions to reduce Grade 2 disability through early detection and treatment of leprosy, the spread of the disease in the community could be prevented.^[1] Grade 2 disability rate at the time of leprosy diagnosis has gained the attention of researchers, but data on Grade 1 disability are still lacking. Detection of disability at an earlier stage (Grade 1) and adoption of protective lifestyle measures may prevent further progression to Grade 2 disability and deformity.

In this background, we decided to carry out a cross-sectional study in our tertiary care institution on the prevalence of Grade 1 and 2 disability in patients with newly diagnosed leprosy and tried to identify

any clinical features that placed a patient at risk for developing the same.

Materials and Methods

After obtaining clearance from institutional ethics committee, all newly diagnosed leprosy patients who attended the dermatology department of our institution were included in the study during a period of 1 year, from January 1, 2013 to December 31, 2013. A written informed consent was signed by every patient before inclusion in to the study.

Exclusion criteria

Patients who had disabilities due to causes other than leprosy and patients who developed disabilities after starting the treatment of leprosy were excluded from the study.

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Data regarding age, sex, occupation, socioeconomic status (modified Kuppaswamy's socioeconomic scale), history of exposure to cases of leprosy, duration of disease, symptoms pertaining to the disease, and comorbid conditions were collected. The presenting complaints such as skin lesion, tingling and numbness, spontaneous blister, weakness and deformities of hands and feet, edema of hands and feet, fissures, trophic ulcers, eye, and nasal symptoms were noted.

Skin lesions were assessed in individual cases with particular reference to the number, size, shape, margin, trophic changes, supplying nerves, and sensations. The hands and feet were examined for sensation, edema, erythema nodosum leprosum lesions, absorption of fingers or toes, wasting of muscles, spontaneous blisters, fissures, trophic ulcers, erosions, difficulty in fine movements, and features suggestive of nerve palsy. Peripheral nerves evaluated for nodularity, thickening, and tenderness.

Sensory impairment was detected by inability to appreciate touch (cotton), pain (needle prick), and temperature sensation (hot - water at 40°C, cold - tap water in test tubes). Motor system was assessed by voluntary muscle testing and graded as per Medical Research Committee Scale.

Visual acuity was tested by Snellen's chart. All patients with vision <6/60 were sent for ophthalmology evaluation to confirm the eye involvement and to rule out other causes of visual impairment.

Skin smears from earlobe, representative skin lesion, and dorsal aspect of the middle finger were stained by modified Ziehl-Neelsen method and bacterial and morphological indices were carefully documented. Routine investigations were carried out in all patients. Skin biopsies were performed in all cases. Depending on clinical, skin smear, and histopathology information, patients were categorized into different spectra of Hansen's disease. Clinical evidence of lepra reaction when present was documented.^[2]

The patients were categorized as having Grade 0, Grade 1 and Grade 2 disability as per the WHO disability grading system.^[3] A patient manifesting no sensory or motor nerve function impairment or loss of vision due to leprosy was considered as having Grade 0 disability. Grade 1 disability was diagnosed whenever a patient presented with sensory nerve function impairment affecting hands or feet without motor nerve function impairment affecting these sites (due to leprosy) or visual impairment better than 6/60 due to leprosy. Grade 2 disability was diagnosed when there was motor nerve function impairment or visible deformity of hands or feet or visual impairment <6/60 due to leprosy.^[3]

Statistical analysis was done using SPSS for Windows, Version 15.0. (SPSS Inc., Chicago, Ill, United States

of America). To identify risk factors associated with disability, binary logistic regression was performed. All the significant variables were taken as covariates and were taken into consideration for multiple logistic regression.

Results

During the 1-year study period, 76 of 198,021 patients (0.02%) who attended our institution were newly diagnosed to have leprosy. Of these, 57 were male (male:female = 3:1). The most common spectrum of leprosy was borderline tuberculoid (24 males and 15 females, 51.3%) followed by pure neuritic (13 males and 3 females, 21.1%).

Of these 76 patients, 39 patients (51.3%) had no disability involving eyes, hands or feet [Table 1]. Grade 1 disability was observed in 13 patients (17.1%) and Grade 2 in 24 patients (31.6%).

Tables 2 and 3 show the statistical analysis of factors associated with the disability. The odds of developing disability in patients above 45 years is 3.07 (95% confidence interval: 0.83 to 11.29), on adjusting for other variables. Thirty out of the 57 males (52.6%) and 7 of the 19 (36.8%) females had disability.

Low socioeconomic classes were found to develop more disabilities. Thirteen study participants were manual laborers. Seven of the thirteen (53.8%) had disability at the time of diagnosis of which six (46.2%) had Grade 2 disability. Ten patients were homemakers and four of them (40%) had developed disability (2 patients each with Grade 1 and Grade 2) at the time diagnosis.

The most common Grade 2 disability affecting eye in the study population was facial nerve palsy (2 patients). Three others had madarosis, though not considered as a feature of Grade 1 or Grade 2 disability as per the WHO disability grading.

Most common Grade 2 disability affecting hands was claw hand in 10 patients (1 female and 9 males), whereas sensory loss was the most common Grade 1 disability (6 patients) [Figure 1a]. Most common Grade 2 and Grade 1 disabilities in feet were trophic ulcer in 10 patients (9 males) and loss of sensation in 10 patients, respectively [Figure 1b]. Other disabilities

Table 1: Disability affecting eye, hand, and foot in the study group

Site of disability	Grade of disability						Total (%)
	Grade 1			Grade 2			
	Male	Female	Total	Male	Female	Total	
Eye	2	0	2	0	0	0	2 (2.6)
Hand	5	1	6	16	2	18	24 (31.6)
Foot	7	3	10	9	1	10	20 (26.3)
Total	9	4	13	21	3	24	37 (48.7)

noted were muscle wasting (7 patients) and foot drop (1 patient) [Figure 2].

Table 2: Simple logistic regression analysis of factors associated with disability

Variables	Without disability (n=39), n (%)	With disability (n=37), n (%)	P
Age			
45 and below	30 (62.5)	18 (37.5)	0.012
Above 45	9 (32.1)	19 (67.9)	
Sex			
Male	27 (47.4)	30 (52.6)	0.237
Female	12 (63.2)	7 (36.8)	
SES			
Low SES	7 (41.2)	10 (58.8)	0.345
Middle and high	32 (54.2)	27 (45.8)	
Duration (months)			
<6	14 (46.7)	16 (53.3)	0.513
>6	25 (54.3)	21 (45.7)	
Number of skin lesion			
≤5	30 (57.7)	22 (42.3)	0.105
>5	9 (37.5)	15 (62.5)	
Number of nerve trunks			
0-1	17 (73.9)	6 (26.1)	0.012
≥2	22 (41.5)	31 (58.5)	
Reaction			
Absent	36 (55.4)	29 (44.6)	0.097
Present	3 (27.3)	8 (72.7)	
Spectrum of leprosy			
Lepromatous and indeterminate	7 (43.8)	9 (56.2)	0.002
Tuberculoid	31 (70.5)	13 (29.5)	
Pure neuritic	1 (6.2)	15 (93.8)	
Smoking			
Absent	37 (53.6)	32 (46.4)	0.194
Present	2 (28.6)	5 (71.4)	
Alcoholism			
Absent	37 (54.4)	31 (45.6)	0.115
Present	2 (25)	6 (75)	
Diabetes			
Absent	38 (51.4)	36 (46.4)	0.74
Present	1 (28.6)	1 (71.4)	

SES: Socioeconomic status



Figure 1: (a) Trophic changes affecting fingers in lepromatous leprosy. (b) Trophic changes affecting toes in lepromatous leprosy

Among the study participants, a statistically insignificant association was noted for duration of symptoms and disability.

Irrespective of the sex, patients with borderline tuberculoid and pure neuritic disease were found to be at greater risk for developing Grade 1 disability (38.46% each). The most common spectra of Hansen’s disease manifesting Grade 2 disability at the time of diagnosis were pure neuritic followed by borderline tuberculoid disease, and this was found to be statistically significant ($P=0.002$). More than five skin lesions were detected to be a significant factor for both Grade 1 and Grade 2 disabilities ($P=0.045$).

Nerve trunk enlargement was associated with Grade 1 and Grade 2 disabilities and the odds of disability increased (adjusted odds ratio 3.339) when two or more nerve trunks were involved. Patients with positive smear status and those who required multibacillary treatment were also found to be related with disability, especially Grade 2 disability.

Of the 76 patients with newly diagnosed leprosy, 11 presented with lepra reaction. Ten were Type 1 and one was Type 2 lepra reaction. A higher percentage of patients with lepra reaction (72.7%) developed disability compared to those without clinical evidence of lepra reaction though statistically insignificant ($P>0.05$).

Discussion

The impairment, disability, and deformity remain a major hindrance in leading a normal social life even in adequately treated leprosy patients and is the root cause of stigma associated with the disease. Data on disabilities, deformities, and probable risk factors for the same are essential to improve our understanding of the challenges and complications posed by this ancient disease.

Disability rate in newly diagnosed leprosy cases observed in the present study (48.7%) was between the



Figure 2: Foot drop in pure neuritic leprosy

Table 3: Multiple logistic regression analysis of factors associated with disability

Variables	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	P
Age			
≤45	1	1	0.091
>45	3.519 (1.314-9.423)	3.072 (0.835-11.29)	
Duration (months)			
<6	1	1	0.577
>6	0.735 (0.292-1.849)	0.697 (0.196-2.48)	
Number of skin lesion			
≤5	1	1	0.045
>5	2.273 (0.842-6.13)	5.425 (1.035-28.44)	
Number of nerve trunks			
0-1	1	1	0.122
≥2	3.992 (1.36-11.74)	3.339 (0.725-15.38)	
Reaction			
Absent	1	1	0.297
Present	3.310 (0.805-13.62)	2.755 (0.411-18.48)	
Spectrum of leprosy			
Pure neuritic	1	1	0.002
Tuberculoid	0.028 (0.003-0.234)	0.020 (0.002-0.190)	
Lepromatous and indeterminate	0.086 (0.009-0.815)	0.008 (0.00-0.155)	

OR: Odds ratio, CI: Confidence interval

documented disability rates of 10% to 80% noted in the previous studies.^[4-6] This wide disparity could be due to the difference between field studies and hospital-based studies. Patients with more severe or extensive disease tend to attend hospital; hence, hospital-based studies record higher percentage of people with Grade 1 and Grade 2 disabilities at the time of diagnosis.

The higher rate of disability associated with male sex in our study was noted by others as well.^[6-9] It can be explained by the fact that males are more prone to trauma to hands and feet as part of their occupation. A statistically significant association noted for disability and age above 45 years is in accordance with several other studies.^[9-11]

Majority of our study participants belonged to low and middle socioeconomic classes as expected in a study conducted in a government institution. More Grade 2 disability observed among low socioeconomic class and migrant laborers could be attributed to the ignorance of

disease symptoms and avoidance of seeking medical help until very late in the disease. In addition, as part of their heavy work, they are more prone to injuries.^[12,13]

In our study, among females, homemakers were more prone to disability development, and this was similar to the finding of Chavan *et al.*^[13] Homemakers are more likely to sustain minor burns, scratches, and cuts as part of household work and compared to employed women, they tend to ignore minor injuries and avoid seeking medical help.

Sarkar *et al.*^[14] described feet as the most common site of disability while others including us noted hands to be the most commonly involved site as far as disability was concerned.^[6,10,15] Many studies including ours noted trophic ulcer (foot) as the most common Grade 2 disability and attributed this to the fact that anesthesia of feet remained unrecognized and came to light only when patients presented with ulceration.^[4,13,16] Moreover, cracks and fissures are more common in feet, which if not taken care of, can result in ulceration. Literature suggests that females are at greater risk for developing trophic ulcers of feet owing to the lack of knowledge about the disease and the ignorance about the lifestyle modifications to be adopted as well as the inaccessibility to health-care system in the female population.^[13] But in our study only, one of the ten trophic ulcer patients was a female, reflecting the high education status and easy health-care access enjoyed by the women of the state. Our finding of ocular Grade 2 disability in 2.6% of patients was similar to the observations of many.^[5,12,14] But a recent study by Singh *et al.* noted nearly 40% of patients affected with disability involving eyes.^[17]

Although we noticed increased occurrence of disability in patients seeking treatment late after the onset of disease, this was not found to be statistically significant. Most studies have reported statistically significant association between delay in diagnosis and Grade 2 disability.^[8,12-14,18] This discordance in our study could be explained by the patient profile seeking treatment in a tertiary referral center. Usually, patient with severe disease attends a referral unit. Patients who develop disability early in the disease, though less in number almost always approach a tertiary care institution, whereas those with skin lesions alone, often tend to take treatment from a nearby doctor. Hence, unlike in a population-based study, Grade 2 disability at the time of diagnosis among patients attending a referral center does not reflect the delay in initiation of treatment.

Our finding of higher chance of disability in pure neuritic cases has been reported by others.^[8,12] Diagnosis of neuritic leprosy is often delayed as patient remains unaware of the condition and seeks treatment only when the disability sets in. The significant proportion of borderline tuberculoid cases developing disability noted

in our study could be due to the relatively more compact epithelioid granuloma of borderline tuberculoid spectrum exerting considerable pressure on the nerve fibers. The same was observed in a recent south Indian study.^[19] Moreover, borderline tuberculoid patients are more prone to manifest type 1 lepra reaction, a well-known cause for nerve palsy in leprosy.

As stated in literature, more than five skin lesions and nerve thickening, especially multiple nerve trunk enlargement were associated with higher chance for disability in our study.^[8,12,14] Diagnostic delay, lepra reaction, and extensive disease, all the three common causes for multiple skin lesions in leprosy, were recognized as risk factors for disability. Some studies observed more than 10 skin lesions to be a risk factor for disability.^[8]

The significant predictors of disability identified in the current study (age, number of skin lesions, number of peripheral nerve trunks, and spectrum of leprosy) were consistent with existing data, and many previous studies failed to establish a significant association between delay in diagnosis and presence of disability at initial presentation.^[8,12,13]

Limitations of the study

The main limitation was the fact that the study was conducted in a tertiary care unit. This results in selection bias as patients with more severe disease attend a referral center and the study does not reflect the status in the community. It has been recognized that patients without any disability at the time of diagnosis may develop the same at the completion of treatment.^[16] Our study was not designed to collect data on this aspect. However, the strength of our study was that we were able to gather information on Grade 1 disability rate as well. An idea on the prevalence of Grade 1 disability rate is of utmost importance in the prevention of disability, as intervention and patient education at the stage of Grade 1 disability may prevent progression to Grade 2 disability. Integration of leprosy control programme into the primary health-care system could have resulted in lack of awareness of the disease among public and health-care professionals resulting in delay in recognizing the subtle signs of the disease at an early stage. This study further highlights the need for frequent leprosy education classes for public as well as for health-care professionals.

Conclusion

The major risk factors identified for the development of disability due to leprosy at the time of diagnosis were age, number of skin lesions, number of peripheral nerve trunk involvement, pure neuritic, and borderline tuberculoid spectra of disease. We suggest more prospective studies that compile information on

disability and deformity associated with leprosy at the time of diagnosis, during treatment, at the completion of treatment, and at follow-up visits. These may improve our understanding about the factors precipitating disability which may help us to devise proper preventive measures as well as to ensure better rehabilitation of the affected.

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Conflicts of interest

There are no conflicts of interest.

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