

## Study of Clinical Spectrum and Factors Associated with Disabilities in Leprosy: A Ten Year Retrospective Analysis

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Leprosy/Hansen's Disease (HD) is associated with impairments and disabilities leading to stigma attached to the disease. Our study looks at the clinical spectrum and factors associated with disabilities over a 10 year period. It was a cross sectional retrospective analysis and included 240 patients which were followed in Christian Medical College and Hospital, Ludhiana, a Tertiary Care Hospital in North India. Objective of the study was to assess the pattern, prevalence and risk factors of disabilities in leprosy patients. The findings shows that the overall prevalence of disabilities was 57.9% (n=139) and was more common in males (73.4%). Patients, residents of Punjab had the maximum prevalence of disabilities (37.4%) followed by Bihar (27.3%). The commonest visible disability was madarosis (19.6%) followed by claw hand (12.1%). The maximum prevalence of clawing was noted in patients with BT-HD (31%) followed by TT-HD (27.6%). WHO Grade 1 disability was 24.5% while 60.4% had WHO Grade 2 disability. On multivariate analysis, positive skin smears and presence of lepra reaction at the time of diagnosis were found to be the risk factors associated with disabilities in leprosy. While the magnitude of disabilities in a referral tertiary care settings will not reflect true extent of problem in the community, information is relevant for improving the preventive and management strategies. Even in the post elimination era of leprosy, significant number and types of disabilities still persist. Like the tip of an iceberg, these findings imply that a more vigorous approach towards early and adequate treatment of complications like reactions is the need of the hour. Community based intervention studies in partnership with tertiary care hospitals may be useful in taking appropriate public health measures.

**Key words :** New leprosy patient, WHO disability grading, Leonine facies, Tertiary Care Hospital, North India

### Introduction

The ancient disease of Leprosy is primarily associated with various disabilities which develop if untreated or not properly treated, and are responsible for the stigma attached to the disease. The war against this ancient disease has

not yet been won. At the end of 2005, India achieved elimination of leprosy (0.95/10000 population). Since elimination is not eradication of the infection, new cases continue to present and remain a challenge in the post elimination era. Disabilities are still prevalent even though the

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world wide prevalence of leprosy has markedly reduced due to the wide spread implementation of MDT. According to the Global leprosy strategy (2016–2020), the prevalence at the end of 2016 was 171,948 with a registered prevalence rate of 0.23 per 10,000 population. Singh et al (2014) found ocular disability in 39.40% of leprosy cases in his study. To reduce the burden of disabilities, early detection through active and passive screenings, early treatment of the disease and its associated reactional states, follow ups, counselling, self-care, physiotherapy and surgical interventions are required. They will help in reducing the prevalence of disabilities and thereby decrease the stigma associated with it. Leprosy is notorious to be associated with characteristic disabilities which tend to have remained unchanged over millenniums, thus the stigma associated with the disease even though the infection is treatable with the multi-drug treatment (MDT).

WHO defines deformity as a visible alteration of the body part and disability as the reduction in the function of the concerned body part. Nerve damage leads to deformities and disability. These terminologies are used interchangeably in the field of leprosy. The prevalence of leprosy disabilities is 25-30% in the Indian population as reported by Husain (2011). The prevalence and severity of disabilities can indirectly measure the transmission of the infection according to Schreuder (1998). It also reflects on the active interventions to treat the disease and prevent disabilities. Hence early case detection remains the key but it still manifests in relapse patients too with a prevalence of 31% as reported by Prabu et al (2015).

We undertook this study to generate awareness among the health care providers regarding the clinical spectrum of the WHO disabilities, its prevalence and their associated socio economic

and clinical risk factors in the post elimination era. The prevalence of disabilities in patients of leprosy presenting to a tertiary care centre reflect the burden of disabilities in the general population. Integration of health care facilities at the primary and secondary health care level is the need of the hour to provide awareness and tertiary care hospital is a referral centre regarding confirmation of diagnosis of leprosy and treatment of lepra reactions as well as neuritis in order to prevent these disabilities.

### **Materials and Methods**

This cross sectional retrospective study was undertaken in the Department of Dermatology Venereology and Leprology, Christian Medical College Hospital, Ludhiana, a tertiary care medical college hospital in Punjab, India. Objective of the study was to assess the pattern, prevalence and risk factors of disabilities in leprosy patients coming to the OPD of Department of Dermatology, Venereology & Leprosy for treatment. The reported prevalence of leprosy in the state of Punjab is 0.18/10000 population (NLEP 2018). After the approval of the Institutional Research committee, data of all new leprosy patients presenting to the outpatient department (OPD) from January 2007 till December 2016 was retrieved using a pretested instrument. The data collected included age, sex, occupation, marital status, contact with leprosy patient and delay in presentation to the hospital. For the purpose of analysis occupation was categorised as manual labourers, non-manual workers and house wives. Clinical data included clinical classification by Ridley/ Jopling and WHO clinical classification, lepra reaction, nerve involvement, slit skin smear status, WHO grading of disability, motor and sensory Nerve function impairment (NFI).

The various clinical parameters taken into consideration are as follows:

Pauci bacillary (PB) and multibacillary (MB) classification was used as defined by WHO. Pure neuritic leprosy was defined as PB if a single nerve thickening was noted along with NFI (Sensory and/or motor) while it was labelled as MB if 2 or more nerve thickenings were noted along with the NFI (Sensory and/or motor). Brandsma & van Brakel (2003) used the WHO disability grading to grade the individual disabilities and the maximum grade was considered the overall disability grade.

Nerve function impairment was tested as clinically detectable impairment of either motor, sensory or autonomic nervous system by Croft et al (1999).

Voluntary muscle testing (VMT) detects the motor NFI by grading the muscle power as strong (S), weak (W) or paralysed (P). Motor NFI is said to be present if weak and or paralysed muscles were noted. The disability of the eye was also graded according to the WHO guidelines (Brandsma & van Brakel 2003).

The department follows the procedure for sensory testing of the hands and feet as described by Van Brakel et al. The tip of the ball point pen is used to induce just a slight indentation of the skin, 6 sites over the palm and 4 over the soles. One insensitive point is considered when the patient is unable to identify the touch within 2 cm of the tested site with eyes closed. The test is positive if 2 or more sites show the insensitive point either on the palms or soles as documented by Owen & Stratford (1995).

### Statistical analysis

Data was entered in Microsoft Excel and was analysed using SPSS version 21. Descriptive analysis, frequency, proportions, mean and standard deviation (SD) were done. Chi-square test, t-test and ANOVA were the tests of significance. The variables which were significant were further analysed using logistic regression.

### Results

We reviewed the leprosy records of 240 patients, and out of which 177 (73.8%) were males. The history of contact with a leprosy patient was noted in 34 patients only (14.2%). The mean age at presentation was 32.74±13.03 years. The mean duration of presentation after the onset of symptoms was 32.44±42.98 months. The majority of the patients were manual labourers (44.2%) followed by non-manual workers (40.8%) and house wives (15%). The overall prevalence of disabilities was 57.9% (n=139) and they were more common in males (73.4%, n=102) (p=0.023). Patients resident of Punjab had the maximum prevalence of disabilities (n=52, 37.4%) followed by Bihar (n=38, 27.3%) and UP (n=29, 20.93%).

Fifty five patients (22.9%) had sensory NFI and motor NFI was seen in 33 patients (13.75%). The commonest visible disability was madarosis seen in 47 patients (19.6%) followed by claw hand in 29 patients (12.1%). Other frequently occurring disabilities noted were trophic ulcers in 22 patients (9.2%), gynaecomastia in 13 patients (5.4%), fissured feet in 11 patients (4.6%), resorption of digits in 10 patients (4.2%) and leonine faces were seen in 9 (3.8%) lepromatous spectrum of disease (Table 1). The maximum prevalence of clawing was noted in patients with Borderline Tuberculoid Hansen's disease, BT-HD) (n=9, 31%) followed by Tuberculoid Hansen's Disease, TT-HD (n=8, 27.6%) (p=0.001). The most common clinical diagnosis was BT-HD (n=81, 33.8%) followed by Lepromatous Hansen's Disease, LL-HD (n=41, 17.08%). Maximum motor NFI was noted in LL-HD (partial 7 (19.4%), weak=6 (14.6%) followed by Pure Neuritic Hansen's Disease, PN-HD (partial 4 (16.7%), weak=8 (33.3%) (p=0.000). Maximum sensory NFI was noted in LL-HD (n=21, 51.2%) (P=0.000). Disabilities were more common in the LL-HD

**Table 1 : Spectrum of visible disabilities observed in the cases studies**

Disability type		N=139*	%
<b>Eye</b>	Madarosis	47	19.6
	Loss of corneal sensation	8	3.3%
	Lagophthalmos	6	2.5%
	Visual impairment<6/60	5	2.1%
	Corneal opacity	3	1.3%
	Iridocyclitis	1	0.4%
<b>Hands and feet</b>	Sensory NFI	55	22.9%%
	Motor NFI	33	13.8%
<b>Claw hand</b>	Total	29	12.1%
	Unilateral	23	9.6%
	Bilateral	6	20.7%
	Trophic ulcers	22	9.2%
	Fissured feet	11	4.6%
	Resorption of digits	10	4.2%
	Foot paresis	4	1.7%
	Foot drop	3	1.3%
<b>Others</b>	Gynaecomastia	13	5.4%
	Leonine facies	9	3.8%
	Facial nerve palsy	4	1.7%

\* One patient can have more than one disability.

spectrum (85.4%) followed by BT-HD (31.7%) and TT-HD (14.4%) (p value=0.001) (Table 2).

Forty patients had WHO Grade 1 disability (16.70%) while 99 (41.30%) had WHO Grade 2 disability. The WHO grading of disability correlated with the clinical diagnosis, pure neuritic and LL cases had higher disability rates (Table 3).

As expected, the MB spectrum of the disease presented with maximum disabilities. Of the total 202 patients with MB disease, disabilities were noted in 125 patients (61.88%) (p=0.004). Manual labourers had 47.5% of the disabilities; non-manual workers had 38.8%, while 15% of the House wives had disabilities. Disabilities, even

though were commoner in the patients with a positive history of contact (55.9%) were not statistically significant. (p=0.67)

Of the total 106 patients who presented with lepra reaction (44.2%), sensory NFI was noted in 55.2% of the patients and this finding was statistically significant (p=0.032). Another significant finding was the higher prevalence of disabilities (74.5%) in patients who had presented with lepra reaction (p=0.000). Presence of lepra reaction also correlated significantly with the WHO Grading of disability (Table 4). Out of 55 patients with positive skin smears, disabilities were prevalent in 67.3% which was also statistically significant (p=0.05).

**Table 2 : Frequency of disabilities in leprosy cases across the spectrum**

Spectrum of disabilities	Clinical diagnosis					
	TTHD n=38	BTHD n=19	BBHD n=28	BLHD n=19	LLHD n=41	PNHID n=24
Clawing	16	9	4	2	16	3
Madarosis	8		14	5		4
Foot Paresis	5		1			3
Foot Drop			1		1	1
Fissured Feet	3	3	1		3	
Facial Nerve Palsy	2		2			
Loss of Corneal Sensations	2	3				
Corneal opacity					3	4
Iridocyclitis					1	
Lagophthalmos	1	2				1
Trophic Ulcers			9	1	8	3
Resorption of digits				2	10	9
Leonine facies				1	1	
Gynaecomastia					13	
Visual impairment					5	

\* One patient can have more than one disability.

**Table 3 : Correlation of WHO Grading of disability with clinical diagnosis**

Clinical diagnosis	WHO Grading of disability						Total	Chi Sq P value
	0	1	2					
BBHD	14 (50.0%)	3 (10.7%)	11 (39.30%)				28	30.448 (0.002)
BLHD	9 (47.4%)	3 (15.8%)	7 (36.80%)				19	
BTHD	37 (45.7%)	15 (18.5%)	29 (35.80%)				81	
IDHD	8 (88.9%)	1 (11.1%)	0 (00.00%)				9	
LLHD	6 (14.6%)	13 (31.7%)	22 (53.70%)				41	
PNHD	9 (37.5%)	1 (4.20%)	14 (58.30%)				24	
TTHD	18 (47.4%)	4 (10.5%)	16 (42.10%)				38	
Total	101 (42.1%)	40 (16.7%)	99 (41.30%)				240	

Majority of the disabilities were noted in the age group of 20-30 years (n=56, 40.28%) followed by age group of 30-40 years (n=30, 21.58%) as shown in the Kaplan Meier Curve (Fig 1). Below 12 years

of age (n=7), the prevalence of disabilities was 71.42%.

Palpable nerves were noted in 204 patients (85%) while neuritis was seen in 103 patients (42.9%).

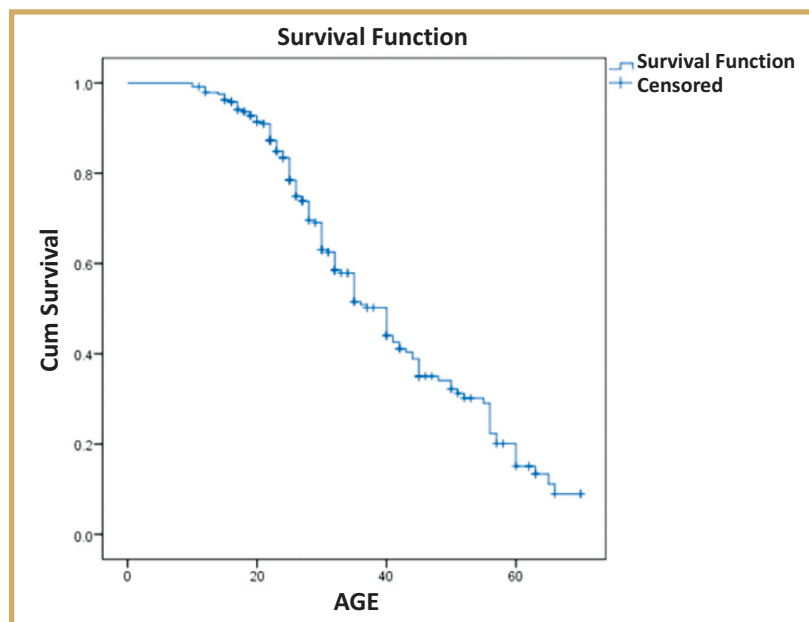


Fig. 1 : Kaplan Meier Curve showing disabilities by age at presentation.

Table 4 : Correlation of lepra reaction with WHO grading of disability

Lepra reaction	WHO Grading of disability						Total	Chi Sq P value
	0		1		2			
No	74	(55.20%)	18	(13.40%)	42	(31.30%)	134	21.571 (0.000)
Yes	27	(25.50%)	22	(20.80%)	57	(53.80%)	106	
Total	101	(42.10%)	40	(16.70%)	99	(41.30%)	240	

Table 5 : Correlation of WHO grading of disability and site involved

Site involved	WHO Grading of disability						Total	Chi Sq P value
	0		1		2			
Only skin	101	(100.00%)	0	(13.40%)	0	0	101	240.000 (0.000)
Neuritis	0	0	40	(28.80%)	99	(71.20%)	139	
Total	101	(42.10%)	40	(16.70%)	99	(41.30%)	240	

There was no correlation between the number of nerves involved and the prevalence of disabilities. The frequency of disabilities was more in the presence of neuritis (n=103, 54.21%) compared

to pure cutaneous involvement (n=36, 72%) (p=0.012). Presence of neuritis correlated with the WHO Grading for disability as well (Table 5).

## **Discussion**

Leprosy caused disabilities lead to stigmatization and discrimination with the patients in their family and community. We found an overall prevalence of disabilities to be 57.9%. An international study involving high endemic areas conducted by Zhang et al (1993) reported 56.97% disabilities. Ganapati et al (2003) reported that 33-56% of newly diagnosed cases had nerve function impairment and if appropriate services are made available at community level disability status can be improved in 50% of them. Higher prevalence of disabilities reflects poor epidemiological control and disease transmission in the post elimination era. While our study documented WHO Grade 1 disability as 24.5%, WHO grade 2 disabilities was almost double (60.4%). Nayak et al and Singal & Sonthalia (2013) reported a prevalence of 39.13% and 37% respectively for WHO Grade 2 disabilities while our study is almost twice their findings. This difference in prevalence could be explained on a number of factors. The higher degree of referrals for management of disabilities to a tertiary centre, delay in health seeking behaviour and cross sectional analysis of the data in our study could explain the differences. Nearly 10% of the cases reported from the city of Ludhiana are seen in CMC. As per NLEP (2018), Ludhiana contributes nearly 25% cases in the state of Punjab. The state of Punjab reports annual deformity of 6.61 % of the cases. In our study the prevalence of disabilities was 57%, noted over a period of 10 years. There are many contributing factors to this large number. The hospital of repute is 125 years old and has been treating leprosy since its inception. This tertiary care centre provides holistic treatment to the leprosy patients who present with disabilities by giving corrective management involving specialities like Plastic Surgery, Orthopaedics, Physiotherapy and Physical and Medical Rehabi-

litation. Since explains the high degree of disabilities seen in the patients coming to our hospital.

Males had a higher prevalence of disabilities in our study (73.4%) comparable to the data published by Nayak et al (2017). The disease seems to manifest frequently in middle aged people with an insignificant gender predilection. This remains a major cause of concern and high monitoring group as they are active contributors to the family income and disabilities in this age group compromises the bread winning status and affects the economic status of the family and society in general.

Disabilities were more common in the LLHD (85.4%) followed by BTHD (31.7%) and TTHD (14.4%). In theory, we can safely presume that the patients with a hypopigmented anaesthetic patch are diagnosed early due to more awareness amongst the people living in leprosy prevalent areas hence less chance of disabilities. This however is not true. This is reflected by the higher prevalence of disabilities in the BTHD and TTHD cases in our study. Other factors for the prevalence of disabilities like inadequate treatment of lepra reactions, incomplete and irregular MB-MDT or inadequate counselling for prevention of trophic ulcers may have become the confounding factors.

Maximum motor NFI was noted in LLHD and PNHD and the findings were statistically significant. Pure neuritic leprosy cases are often missed in the early stages of the infection due to emphasis on evaluation of hypo pigmented anaesthetic skin lesions which are rare in this type of leprosy. Hence, more prevalence of disabilities in this group due to lack of appropriate treatment at the onset of the disease itself. Maximum sensory NFI was noted in LLHD which is statistically significant.



Higher prevalence of WHO grade 1 disabilities were noted in those patients who presented with lepra reaction ( $p=0.032$ ). WHO grade 1 disability is often ignored as it is subtle but its early detection and management can prevent its progression to WHO Grade 2 disabilities. As expected, the MB spectrum of the disease presented with maximum disabilities (85.6%) similar to data reported by Nayak et al (2017) and Zhang et al (1993).

Positivity of the skin smears correlated with the higher prevalence of disabilities (67.3%). This can be easily explained as the disabilities tend to be commoner in the lepromatous spectrum.

In our study the prevalence of disabilities in children <12 years was 71.4% which is in contrast to the study done by Chaitra & Bhat (2013) where the prevalence was 13.89% only. Our numbers were small in this age group but disabilities were still noted in them at the time of presentation. In endemic areas the health seeking behaviour is good and the health care professionals are more experienced to deal with even subtle manifestations of this infection.

The significant univariate variables related to disabilities in our study included clinical diagnosis ( $p=0.001$ ), Male patients (0.023), presence of lepra reaction at the time of diagnosis ( $p=0.032$ ), positive skin smears ( $p=0.05$ ), presence of neuritis ( $p=0.012$ ) and MB spectrum of disease ( $p=0.004$ ). When these were included for multivariate analysis, positive skin smears and presence of lepra reaction at the time of diagnosis continued to remain significant.

Leprosy/Hansen's Disease is associated with disabilities and stigma. The disabilities were found to be more in the middle aged which should alarm the physician for aggressive screening in this age group. Patients with positive skin smears and presenting with lepra reaction have more probability of developing disabilities. Hence

immediate and aggressive management of lepra reaction at the start itself would help in decreasing the rising prevalence of disabilities. The physician should actively look for subtle signs of lepra reactions in the more vulnerable clinical groups such as lepromatous spectrum with each follow up and should also counsel the patients to look for the symptoms and signs of lepra reaction and thereby present early for active management.

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