Indian J Lepr 2020, 92 : 183-189

http://www.ijl.org.in

Original Article

Hand Disability Grading in Leprosy: Associated Risk Factors

RK Wardhani[1], LK Wahyuni[2], M Harini[3], A Lakmudin[4]

Received : 14.03.2020 Accepted : 27.06.2020

Leprosy is an important chronic infectious disease in many developing countries with a projection of 1 million people living with WHO grade 2 disability by 2020. Several factors are thought to play a role in disability development in leprosy including the type of leprosy, the number of nerve trunk involved, leprosy reaction and duration of active disease. The aim of this study is to understand associated risk factors for the development of hand disability in leprosy patients in Indonesia. This is a cross-sectional study on 77 leprosy patients conducted in August 2019 in Alverno Leprosy Hospital, Singkawang, Indonesia to study the risk factors for hand disability. Associated risk factors include age with odds of 1.055 CI (1.015-1.096) p 0.007, females with odds 0.156 CI (0.048-0.508) p 0.002 and history of dropout from treatment with odds 4.225 CI (1.158-15.410) p 0.029. Understanding risk factors for hand disability in leprosy is an important step in moving towards reducing the rate of this disability development. Reducing the duration of active disease by early detection, prompt as well as adequate treatment and strict follow-up are likely to be critical factors in reducing the risk of disability.

Keywords : Leprosy, Hand, Disability Grading, Risk Factors, Indonesia

Introduction

Leprosy is an important chronic infectious disease especially in developing countries with high rates of poverty, overcrowding and under nutrition. It is a major public health problem due to the disabilities that come with it. World Health Organization (WHO) disability grading system is currently used to measure the extent of disabilities for leprosy patients. It is projected that there will be 5 million new cases between 2000 and 2020 with an estimation of 1 million people living with WHO grade 2 disability (Sanford et al 2016, Richardus & Habemma 2007).

Disability can be defined as a difficulty in functioning at the body, personal, or societal levels, in one or more life domains, as experienced by an individual with a health condition in interaction with contextual factors (Leonardi et al 2006). The bacterium, *Mycobacterium leprae,* infects the skin and peripheral nerve fibres

[1] Rizky Kusuma Wardhani, M.D., Physiatrist, Primary Investigator
[2] Luh Karunia Wahyuni, M.D., Physiatrist
[3] Melinda Harini, M.D., Physiatrist
[4] Alvin Lakmudin, M.D, M.Res
Physical Medicine and Rehabilitation Department, University of Indonesia, Jl Pangeran Diponegoro No. 71, Kenari, Senen, RW 5, Kota Jakarta Pusat, DKI Jakarta 10430, Indonesia.
Correspondence : Rizky Kusuma Wardhani, ORCID ID : https://orcid.org/0000-0002-5269-7095;
Email Address : rizkykusumawardhani@yahoo.co.id

causing sensory and motor impairment that result in deformities as well as disabilities. The prevalence of disability varies significantly between studies ranging from 10% to 24.3% (Kumar et al 2012).

There are currently very few research studies available on the risk of hand disability in leprosy. Several factors are thought to play a role in the development of leprosy-related disabilities including the type of leprosy, the number of nerve trunk involved, leprosy reactions and duration of active disease (Kumar et al 2012, Lana et al 2013).

Indonesia is ranked third for the highest number of new leprosy cases after India and Brazil (Tiwari et al 2018). We conducted this cross-sectional study in Alverno Leprosy Hospital Singkawang in an attempt to assess the factors that are associated with hand disabilities in leprosy patients.

Patients and Methods

This was a cross-sectional study conducted in Alverno Leprosy Hospital, Singkawang, West Kalimantan, Indonesia in August 2019. It was a part of a collaborative study with *Katamataku* Project involving Ophthalmologists, Dermatologists and Physiatrist from University of Indonesia, Jakarta, Indonesia. The inclusion criteria were : leprosy patients who had received multidrug treatment (MDT) and living in Singkawang and the exclusion criteria were age less than one-year-old and unknown leprosy type. There were 77 patients included in this study. Ethical approval was obtained from Ethical Committee of Faculty of Medicine University of Indonesia – Cipto Mangunkusumo Hospital.

Sociodemographic and clinical information was collected from medical records and also history taking. Hand disability grading was examined by Dermatologists and physiatrists.

The dependent variable was hand disability (no disability or grade I disability or grade II disability). The independent variables were age, sex, education level, type of leprosy (MB, PB), history of leprosy reaction and history of dropout from treatment.

Operational Definitions used are as per WHO criteria (Brandsma & van Brakel 2003, WHO 2018)

G0D – no anaesthesia, no visible deformity or damage in hands.

G1D – anaesthesia present, but no visible deformity or damage in hands.

G2D – visible hand deformity or damage present i.e. claw hands, ulcers, absorption of the digit.

Pauci-bacillary – five or fewer lesions without bacterium found in skin smears.

Multi-bacillary – more than five lesions and/or detection of bacterium in skin smears.

Leprosy Reaction – Type 1 Reaction Reversal Reaction (RR) and/or Type 2 Reaction Erythema Nodosum Leprosum (ENL).

Data Management and Analysis : The collected data were checked by the principal investigator and entry was done using Microsoft Excel. The data were then exported to STATA software for statistical analysis. Frequencies were used to calculate the prevalence of disability; ordered logistic regression was done to calculate the odds ratios with 95% confidence interval.

Results

Results of the study are presented in Tables 1 and 2.

Sociodemographic Characteristics

Of the 77 studied patients, 49 (63.6%) were males and 28 (36.4%) were females, mean age was 49 18.2 years. Table 1 presents the patients' clinical and socio- demographical characteristics of these patients. Concerning education levels, 33 (42.9%) did not attend school, 28 (36.4%) completed primary school education, 5 (6.5%) completed

Table 1 : Socio-demographic and clinical characteristic of leprosy patients in Alverno Leprosy Hospital, Singkawang, West Kalimantan, Indonesia

Variable		n	%
Sex	Male	49	63.6
	Female	28	36.4
Education Level	No Education	33	42.9
	Primary School	28	36.4
	Middle School	5	6.5
	High School	8	10.4
	Bachelor's Degree and Above	3	3.9
Type of Leprosy	Paucibacillary	21	27.3
	Multibacillary	56	72.7
History of Leprosy Reaction	No	32	41.6
	Yes	45	58.4
History of Dropout from Treatment	No	57	74.0
	Yes	20	26.0
WHO Disability Grading	0	38	49.4
	1	10	13.0
	2	29	37.7

Table 2 : Factors Associated with hand disability in leprosy patients in Alverno Leprosy Hospital, Singkawang, West Kalimantan, Indonesia

Characteristics		Odds Ratio (95% CI)	SE	Sig
Age		**1.055 (1.015-1.096)**	**0.021**	**0.007**
Sex	Male	1		
	Female	**0.156 (0.048-0.508)**	**0.094**	**0.007**
Education Level	No Education	3,413,479	4.24e+09	0.990
	Primary School	4,369,532	5.43e+09	0.990
	Middle School	6,054,694	7.52e+09	0.990
	High School	1.60e+07	1.99e+10	0.989
	Bachelor's Degree and Above	1		
Type of Leprosy	Paucibacillary	1		
	Multibacillary	0.381 (0.110-1.310)	0.240	0.126
History of	No	1		
Leprosy Reaction	Yes	0.620 (0.216-1.784)	0.334	0.376
History of	No	1		
Dropout from	**Yes**	**4.225 (1.158-15.410)**	**2.789**	**0.029**
Treatment				

secondary school education, 8 (10.4%) completed high school education, and 3 (3.9%) completed Bachelor's degree and above. 21 (27.3%) presented with paucibacillary leprosy and 56 (72.7%) presented with multibacillary leprosy. 32 (41.6%) did not experience leprosy reaction and 45 (58.4%) did. 57 (74.0%) did not have a history of dropout from treatment and 20 (26.0%) did. As for WHO disability grading, 38 (49.4%) presented with G0D, 10 (13%) presented with G1D and 29 (37.7%) presented with G2D.

Factors Associated with Disability Grading

Table 2 gives details of factors associated with hand disability (grade 0, 1 or 2). The variables were statistically analysed using ordered logistic regression. Among all the factors studied, age, sex and history of dropout from treatment were found be significantly related with hand disability. Age increased the risk of hand disability (OR 1.055, CI (1.015-1.096), p 0.007). Female patients were less likely to have hand disability (OR 0.156, CI (0.048-0.508), p 0.002). Patients with history of dropout from treatment were more likely to develop hand disability (OR 4.225, CI (1.158-15.410), p 0.029).

Patients with bachelor's degree and above were less likely to develop hand disability (OR > 3.41e + 6, p > 0.990. Patients with MB were less likely to develop hand disability (OR 0.381, CI (0.110-1.310), p 0.126). History of leprosy reaction had an OR of 0.620, CI (0.216-1.784), p 0.376.

Discussion

This study revealed that 50.7% of the leprosy patients had G1D or G2D. Among those with disability, 13% had G1D while 37.7% had G2D. Age, sex and history of dropout from treatment are the factors found to be associated with disability. The high prevalence of disability in this study proves that there is still a problem with early detection and prompt treatment specifically in Singkawang. According to Sales et al (2013), early treatment before the presence of any disability can greatly reduce the probability of developing disability in the future. This research showed that 42.9% of the leprosy positive patients did not receive any form of education, which may translate to the fact that there is a lack of knowledge to seek health care at early stage of the disease. Many only looked for treatment when deformities are already present. There were about 4% of the patients below the age of 10 years old which may mean that the disease is still actively spreading. Children are at extremely high risk of contracting leprosy, especially if there is neighbourhood contact, intra-familial contact or presence of more than one leprosy positive in a household (Dogra et al 2014).

Age is one of the factors related with hand disability grading. According to Moschioni et al (2010), the risk of nerve impairment is higher with age. Leprosy is a chronic disease and disability is a complication that takes time to develop, i.e. the longer the active disease is present, the higher the risk of disability (Moschioni et al 2010). The main reason for early detection and prompt treatment with MDT is to reduce the time of active disease, however, we have to understand that MDT does not completely protect the patient from disability (Sales et al 2013). Age is therefore an important factor for the development of hand disability as MDT alone is unable to completely reverse or stop the progression of disability.

Sex is another factor that is associated with prevalence of leprosy and hand disability grading. In this study, females are found to have lower disability grading as compared to males. Different studies found controversial impact of leprosy on male and female. In Asian countries, leprosy affects more males than females which is in accordance to the finding in this study whereby 49 (63.6%) were males and 28 (36.4%) were

females. In Africa, females outnumber males with females suffering a higher proportion of disabilities than males, due to the lack of awareness of causation and access to healthcare as compared to men (Liu et al 2018). In Indonesia, *Jaminan Kesahatan Nasional* (JKN), which is one of the world's largest national health insurance programmes provides free healthcare to 80% of Indonesia's population, meaning that access to healthcare for females in Indonesia is no longer a detrimental issue (The Lancet 2019).

History of dropout from treatment is also an important factor associated with hand disability grading. If the treatment is started and completed before the presence of disability, the rate of deterioration was found to be 4.5/100 PY and this is much higher at 10.5/100 PY if treatment was started and completed at grade 1 or 2 disability (Sales et al 2013). Kumar et al (2012) also suggested that the incidence of disability is higher if treatment is not completed. A history of dropout from treatment is a factor that can be indirectly translated to longer duration of active disease, which is one main contributor of hand disability and can therefore affect disability progression as well as grading.

In this study, 20 (26.0%) out of 77 participants had a history of dropout from treatment. There has yet to be a research on the rate of dropout from treatment specifically in Singkawang, however, several studies found that it ranges between 10-20% in Indonesia (Rachmani et al 2013, Susanti et al 2018). There are many factors for treatment dropout such as socio-economic status, level of knowledge, adverse effects, loss of working hours and distance from patient's residence to the healthcare institution (Girao et al 2013). All 77 participants had an income of less than Rp 400,000.00 per capita, which is under Indonesia's poverty line. 33 (42.9%) out of 77 participants did not undergo any form of proper education. 45 (58.4%) out of 77 participants experienced leprosy reactions. All these factors could contribute to the high rate of dropout from treatment in this study. Further studies on dropout from treatment could be useful in order to pin-point the affecting factors, minimize disability as well as to reduce the rate of leprosy transmission specifically in Singkawang, Indonesia.

In this study, the type of leprosy did not show any association with disability grading. MB type leprosy is known to be associated with higher disability than PB type leprosy. One critical information lacking in this study is the delay in treatment, meaning the duration of symptoms until the start of MDT which may play an important role in determining the progression of disability. According to Kumar et al (2012), delay in treatment has an OR 2.27 (1.04-4.96). It might be possible that the MB type group in this study received treatment earlier than the PB type group, resulting in no association between MB and PB type leprosy with disability grading.

History of reactions did not show any association with hand leprosy grading. According to Pan American Health Organization, reactions occur in 10-30% of all leprosy cases. In this study, there was 45 (58.4%) of patients presenting with history of reactions. It is widely known that reactions, both type 1 and type 2, are main contributors to disability. Steroids have been the mainstream treatment of reactions with an efficacy of up to 70%, however, it is only effective if given within 6 months since the most recent acute episode (Pan American Health Organization 2006). One limitation in this study is that we did not have any data on the treatment of leprosy reaction, such as the time of steroid administration since the onset of the episode, which may be an important factor in determining the rate of disability progression in this study.

Conclusion

Leprosy remains as a contributor of disability in Indonesia. The factors associated with hand disability grading in this study include age, sex and history of dropout from treatment. Even though history of reaction did not turn out to be a factor, it is still crucial to increase awareness of both RR and ENL to ensure early treatment with steroids, preferably 6 months since the onset of the reaction. Early case detection and prompt treatment can only be effective in disability prevention, if follow-ups are done appropriately to ensure completion of MDT as well as early treatment of leprosy reactions.

Acknowledgements

We would like to thank all 77 study participants whose data contributed to this study. We thank *Katamaku* Project for the chance to be a part of this project. We also would like to thank the nurses from Alverno Leprosy Hospital, Singkawang, Indonesia who facilitated the study.

References

1. Brandsma JW, Van Brakel WH (2003). WHO disability grading: operational definitions. *Lepr Rev*. **74(4)**: 366-73.
2. Dogra S, Narang T, Khullar G et al (2014). Childhood leprosy through the post-leprosy-elimination era: a retrospective analysis of epidemiological and clinical characteristics of disease over eleven years from a tertiary care hospital in North India. *Lepr Rev*. **85(4)**: 296-310.
3. Girão RJS, Soares NLR, Pinheiro JV et al (2013). Leprosy treatment dropout: A sistematic review. *Int Arch Med*. **6(1)**: 34.
4. Kumar A, Girdhar A, Girdhar BK (2012). Risk of developing disability in pre and post-multidrug therapy treatment among multibacillary leprosy: Agra MB Cohort study. *BMJ open*. **2(2)**: ee000361.
5. Lana FCF, Fabri ACOC, Lopes FN et al (2013). Deformities due to leprosy in children under fifteen years old as an indicator of quality of the leprosy control programme in Brazilian municipalities. *J Trop Med*. Article ID 812793, http//dx.doi.org/10.155/2013/812793
6. Leonardi M, Bickenbach J, Ustun TB et al (2006). The definition of disability: what is in a name. *The Lancet*. **368(9543)**: 1219-1221.
7. Liu YY, Yu MW, Ning Y et al (2018). A study on gender differences in newly detected leprosy cases in Sichuan, China, 2000–2015. *Int J Dermatol*. **57(12)**: 1492-1499.
8. Moschioni C, Antunes CMDF, Grossi MAF et al (2010). Risk factors for physical disability at diagnosis of 19,283 new cases of leprosy. *Revista da Sociedade Brasileira de Medicina Tropical*. **43(1)**: 19-22.
9. Pan American Health Organization (2016). Consensus statement on prevention of disability. WHO, Geneva, p3.
10. Rachmani E, Kurniadi A, Hsu CY (2013). Health information system model for monitoring treatment and surveillance for leprosy patients in indonesia (case study in Pekalongan District, Central Java, Indonesia). *Stud Health Technol Informat*. **192**: 1096-1096.
11. Richardus JH, Habbema JDF (2007). The impact of leprosy control on the transmission of M. leprae: is elimination being attained. *Lepr Rev*. **78(4)**: 330-337.
12. Sales AM, Campos DP, Hacker MA et al (2013). Progression of leprosy disability after discharge: is multidrug therapy enough. *Trop Med Internat Health*. **18(9)**: 1145-1153.
13. Sanford CA, Jong EC and Pottinger PS (2016). *The Travel and Tropical Medicine Manual E-Book*. Elsevier Health Sciences.
14. Susanti IA, Mahardita NG, Alfianto R et al (2018). Social stigma, adherence to medication and motivation for healing: A cross-sectional study of leprosy patients at Jember Public Health Center, Indonesia. *J Taibah Univ Med Sci*. **13(1)**: 97-102.
15. The Lancet (2019). Successes and challenges for health in Indonesia. *Lancet, London, England.* **393(10166)**: 2.

16. Tiwari A, Dandel S, Djupuri R et al (2018). Population-wide administration of single dose rifampicin for leprosy prevention in isolated communities: a three year follow-up feasibility study in Indonesia. *BMC Infect Dis*. **18(1)**: 324.
17. World Health Organization (2018). Guidelines for diagnosis, treatment and prevention of leprosy. WHO, New Delhi

How to cite this article : Wardhani RK, Wahyuni LK, Harini M et al (2020). Hand Disability Grading in Leprosy: Associated Risk Factors. *Indian J Lepr.* **92**: 183-189.