A prospective observational study of deformities in leprosy in tertiary care center in South India

Samuel Jeyaraj Daniel[1], Ramalingam Suresh Kumar[2,*], Ravindra Arjunan Babu[3]

[1]Associate Professor, [2]Assistant Professor, Junior Resident[3], [1-3]Dept. of Dermatology, Government Thiruvarur Medical College, Thiruvarur, Tamil Nadu, India

***Corresponding Author: Ramalingam Suresh Kumar**
Email: sureshkumargtmc@gmail.com

Abstract

Introduction: The proportion of deformity cases among newly diagnosed leprosy patients and the grade 2 disability rate in a population indicate the efficiency of early detection of leprosy. They also invariably indicate the awareness levels of early signs of leprosy, and access to leprosy services in the community.

Aim: To study the frequency and severity of grade 1 and grade 2 deformity among leprosy cases. To correlate the clinical and socioeconomical factors to emphasize the importance of the health education in prevention of disability.

Materials and Methods: This was an observational study conducted in leprosy OPD of a tertiary care centre in south India between Jan' 2018 and Dec' 2018. About 62 diagnosed Hansen cases with deformities were included in the study after thorough clinical examination, routine and special investigations. Data was compiled and analyzed with percentages and ANOVA.

Results: Out of 212 diagnosed leprosy cases, 62 had deformities, thus making disability and deformity index to be 29.2%. Among newly diagnosed leprosy cases, 2 had grade 1 and 3 had grade 2 deformity. Males (69.4%) with lower socioeconomic group (41.9%) were commonly affected than females (30.6%). Lepromatous type of leprosy (32%) and leprosy cases of more than 2 to 5 years duration (47%) were commonly involved. Among the leprosy cases, disability was seen more in Multibacillary type (80.6%) and those involved in manual occupation (70.1%). Hands (77.4%) were more involved than and feet (40.3%). Anaesthetic (82.2%) deformities were more common followed by specific (30%) deformities. Grade 1(56.4%) deformities were most common followed by Grade 2(43.6%) deformities.

Conclusions: The study showed that deformities and disabilities occurred due to delay in early case detection of grade -1 disability, lack of treatment assess and health education. Training the health care workers on diagnosing nerve thickening and nerve function impairment will prevent the progression of grade 1 disability to visible grade 2 disability thereby reducing the number of new leprosy cases with G2D to less than one case per million population.

Keywords: Deformity grade 2, New hansen case, Multibacillary type, Neurological examination.

Introduction

The current Global Leprosy strategy 2016 – 2020 'Accelerating towards a leprosy free world' aims at consolidating the gains achieved by Multi drug therapy MDT in leprosy control. It also focuses on reducing stigma and promoting inclusiveness for better and earlier diagnosis of leprosy. Innovative approaches for children, women and other vulnerable populations like strengthening referral systems, systematic tracing of household contacts, monitoring drug resistance, simplified treatment approach and assessing the role of post exposure prophylaxis are emphazised[1]. The principles of global strategy are developing country-specific plans, ensuring accountability by strengthening monitoring in all endemic countries and promoting inclusion by establishing and strengthening partnerships with all subjects or communities affected by leprosy. The fundamental of strategy of Sustainable Development Goal 3 aims at reaching health and wellbeing for all by 2030. It also aims to reduce the burden of leprosy at the global and the local level by strengthening government ownership, coordination and partnership, stopping leprosy, its complications, discrimination and promoting inclusion.[1]

One of the key strategic operational changes focuses on early case detection before visible disabilities occur.[2] The main strategy to further reduce the global and local leprosy by 2020 are Zero G2D among paediatric leprosy patients, reducing the number of new leprosy cases with G2D to less than one case per million population and Zero countries with legislation that allows discrimination on basis of leprosy.[3] It also aims at target detection among higher risk groups by conducting campaigns in highly endemic areas or communities thereby improving coverage and access for marginalized sectors. This will result in earlier detection and reduction of patients with grade-2 disabilities (G2D) at the time of diagnosis and to bring the target of G2D rate is less than one per million population. Since 1995-2010, there has been a gradual reduction of G2D every 5 years in the leprosy endemic countries and especially in India by 53.7%.[4] In this scenario, this observational study was conducted in leprosy OPD of a tertiary care centre in south India between Jan' 2018 and Dec' 2018 to study the frequency and severity of grade 1 and grade 2 deformity among leprosy cases with emphasis on newly diagnosed leprosy patients along with clinical and socioeconomical factors.

Materials and Methods

This prospective observational study included 212 cases that attended the Hansens OPD during the study period. They were assessed based on clinical, socio-economical factors and WHO disability grading. Among them the total cases of deformity was 62 and those with newly diagnosed cases were 5. The protocol of the study was approved by the

Institutional ethical committee before commencing the study. Informed written consent was obtained from all the patients before inclusion into the study. The details of clinical and sociodemographic factors from the cases attending Hansen OPD, Govt. Thiruvarur Medical College, were collected and analyzed. The district Thiruvarur, located in southern India has a leprosy prevalence rate of 0.70 for the year 2017. The corresponding prevalence rate of Tamil Nadu for 2017 was 0.41 and when compared to our country was 0.66.[3]

All diagnosed leprosy patients with deformities who presented at the Hansen OPD were included. The Inclusion criteria for the study was all diagnosed leprosy patients with deformities attending Hansen OPD and exclusion criteria were Deformities due to other causes and subjects not willing for inclusion in the present study period. The enrolled cases were advised to come for review after 1 to 2 weeks according to the investigations taken and at regular interval periods during treatment. A detailed history, socio-demographic data and clinical examination was carried out and all subjects according to NLEP manual.[5] All the cases were subjected to routine blood investigations and slit skin smear examination. Suspicious cases of leprosy were confirmed by skin biopsy. Nerve conduction studies, neurological evaluation for thickened nerve and sensory and motor nerve function impairment were done to suspected cases of pure neuritic leprosy cases.[6] WHO - 3 point disability scale classification was used to grade the eyes, hand and foot deformities.[7] Sensory testing for the hands was done in six sites in each palmar aspect and for each foot in four sites.[8] Sensory nerve function impairment was noted by testing the subjects inability to identify the sensory stimulus under 2 cms and was considered a positive result when 2 or more areas did not have sensation.[9]

By assessing the Voluntary muscle testing, positive Motor nerve function impairment was noted as weak and paralysed.[5] Assessment of motor nerve function impairment of both hands against resistance was done by abduction movement thumb, index and little fingers, opposition movement of the thumb and wrist extension movement. Assessment of motor nerve function impairment of both foot against resistance was done by eversion and dorsiflexion of the foot and hallux extension. Impairments that are visible like ulcers, fissures, absorption, clawing, contractures of fingers and toes along with wrist drop and foot drop were noted as Grade 2 deformity. Grade 1 disability of the eye was assessed by noting the corneal sensation loss by using cotton wisp.[7] Motor nerve function impairment assessment of the eyes was noted by the subjects ability to close the eyes with resistance. Impairments of the eye like madarosis, lagophthalmos, conjunctivitis, iridocyclitis and corneal opacities was recorded as grade 2 disability. Xray, orthopaedic and ophthalmological evaluation (for assessing visual acuity using Snellen's chart)[7] were done in selected deformity cases. The reports of all the investigations and opinion were collected and recorded. Data collected were entered and analysed according to the WHO grading of disability and deformity index and compiled in percentages, chi-square and ANOVA method.

Results

On analysis of data from 212 leprosy subjects collected, 62 cases had deformities and disability and the deformity index was 29.2%. Among them newly diagnosed leprosy cases that showed grade 1 disability was two and grade 2 disability was three. Of these 62 cases, 43(69.4%) were male sex and 19(30.6%) were female sex. Hence deformities were more commonly seen in male sex (P = 0.045) compared to female sex with a male:female ratio of 7:3. The age group most commonly affected was 41-50 years with 19 (30.6%) subjects, followed by 20-30 years age group with 14(22.6%) cases.Hence deformities were seen most commonly in the age group of 41-50 years. (P = 0.128) Significant numbers of deformities were noted in lower socioeconomic class 26(41.9%) cases when compared to upper socioeconomic class 17(27.4%) cases. Subjects who do manual work like farmers, construction workers, 43 (70.1%) cases had significant disability (P <0.001) followed by house work. Deformities were significant when the duration of the disease was between 2 to 5 years, 29(47%) cases followed by >5 years 18(29%) cases. Deformities were lowest in 0-2 years duration group 15(24%) cases. (Table 1)

Deformities were commonly seen in lepromatous leprosy spectrum of the disease with 20(32%) cases followed by borderline lepromatous spectrum with 17(28%). (Table 2) Subjects with greater than 5 skin lesions 17(27.41%) cases had lesser disability than subjects with less than or equal to 5 skin lesion 33(53.22%) cases and this data was statistically significant (P <0.001).(Table 3) Significant disability was noted in MB cases 50(80.6%) when compared to PB cases 12(19.35%) and this data was also statistically significant. (P<0.001). (Table 4)

Deformities were more common in the hands 48(77.42%) cases [Fig. 1-2] followed by both hand and feet 41(66.13%). It was further followed by feet 25(40.32%) cases [Fig. 3], face 7(11.29%) cases[Fig. 4], eyes 5(8.06%) cases and ears 5 (8.06%) cases.[Fig. 5](Table 5) In subjects with hand deformities, sensory loss (sensory NFI) was found to be more common 25(40.32%) cases followed by numbness 14(22.58%) cases and weakness of hands(motor NFI) in 11(17.74%) subjects respectively. (Table 6). In case of foot deformities, numbness (paraesthesia) was found to be common with a total of 14(22.58%) cases followed by glove and stocking type of anesthesia in 12 (19.35%) cases, sensory loss (sensory NFI) in 9(14.52%) cases and last by weakness (motor NFI) in 3(4.84%) cases. (Table 7) Grade 2 deformities were seen more commonly in the feet 36 (58.06%)cases when compared to the hands 26(41.94%) cases. Anaesthetic type of deformity was more commonly noted in 51(82.26%) subjects to be followed by specific deformities in 22(35.48%) subjects and paralytic deformity in 20(32.25%) subjects. Specific complications arising due to involvement of hand and foot deformities noted in our study was mycetoma occurring in the hand and foot. [Fig. 6]

This may be due to the farming occupation sector that is more common in the delta districts of south India. In the eyes, corneal sensory loss [Grade 1] was seen in 3.2% of cases followed by lagophthalmos and severe impairment of visual acuity (vision < 6/60) [Grade 2] in 1.8% of cases.

Table 1:Duration of the disease in patients with deformities

Duration of the Disease (years)	No. of patients (n)	Percentage (%)
0 – 2	15	24
2 – 5	29	47
> 5	18	29
Total	**62**	**100**

Table 2 : Spectrum of the disease in patients with deformities.

Spectrum of the disease	No of patients with deformities (n)	Percentage (%)
Borderline tuberculoid (BT)	10	16
Borderline borderline (BB)	3	5
Borderline lepromatous(BL)	17	28
Lepromatous leprosy(LL)	20	32
Pure neuritic type(PN)	12	19
Total	**62**	**100**

Table 3: WHO disability grade in relation to pure neuritic type and skin manifestations in leprosy cases.

WHO disability grade	No. of skin lesions				G1D & G2D	P value
	0 (%)	> 5 (%)	1-5 (%)	Total (%)	Total	
0	8 (40)	45 (72.58)	97 (74.61)	150 (70.75)	0	< 0.001
1	8 (40)	9 (14.51)	18 (13.85)	35 (16.51)	35	
2	4 (20)	8(12.91)	15 (11.54)	27 (12.74)	27	
Total (n)	**20 (100)**	**62 (100)**	**130 (100)**	**212 (100)**	**62**	

Table 4: WHO disability grade in relation to leprosy type

WHO disability grade	Leprosy type			G1D & G2D	*P* value
	PB (%)	MB (%)	Total (%)	Total	
0	35 (74.47)	115 (69.70)	150 (70.75)	0	<0.001
1	9 (19.15)	24 (14.54)	33 (15.57)	33	
2	3 (6.38)	26 (15.76)	29 (13.68)	29	
Total (n)	**47 (100)**	**165 (100)**	**212 (100)**	**62**	

Table 5: Distribution of deformities based on different site of involvement

Site of deformities	No. of patients	Percentage (%)
Hands	48	77.42
Hands and feet	41	66.13
Feet	25	40.32
Eyes	5	8.06
Ears	5	8.06
Face	7	11.29
Others	3	4.84

Table 6: Distribution of deformities in hand

Clinical manifestation	No. of patients	Percentage (%)
Numbness	14	22.58
Sensory loss (S-NFI)	25	40.32
Glove and stocking	11	17.74
Weakness (M-NFI)	11	17.74
Blisters	5	8.06
Ulcer	3	4.84
Partial claw hand	5	8.06
Claw hand	5	8.06

Table 7: Distribution of deformities in foot.

Clinical manifestation	No. of patients (n)	Percentage (%)
Foot drop	5	8.06
Sensory loss (S-NFI)	9	14.52
Numbness	14	22.58
Trophic ulcer	10	16.13
Callosity	6	9.68
Blister	2	3.23
weakness (M-NFI)	3	4.84
Tingling sensation	2	3.23
Clawing of toes	5	8.06
Stiffness of joints	1	1.61
Glove and stocking type of anaesthesia	12	19.35

Fig 1: Photograph showing a case of leprosy with wasting of thenar and hypothenar muscles, and partial claw hand with resorption.

Fig 2: Photograph showing a case of leprosy with partial claw hand and guttering of interossei with resorption.

Fig. 3: Photograph showing a case of leprosy with trophic ulcer of foot and clawing of toes with resorption.

Fig. 4: Photograph showing a case of leprosy with facial nerve weakness, lagophthalmos and madrosis.

Fig. 5: Photograph showing a case of leprosy with ear lobe infiltration.

Fig. 6: Photograph showing two cases of leprosy with grade 2 deformity with associated mycetoma.

Discussion

The critical challenges in leprosy control services are the detection of paediatric patients that is an indicator of the continued presence of undetected patients and continued transmission in the community.The current detection of patients already with deformities and an increased proportion of multibacillary cases (MB) among them indicates that there is a delay in detection in the community. The stigma surrounding leprosy and the discrimination faced by cases affected by the disease like social exclusion, depression and loss of income continues to be challenge for early detection and successful completion of treatment.

The Global Leprosy Strategy 2016–2020 aims at early detection of leprosy cases and prompt treatment to prevent deformity and reduce transmission of infection in the community. The proportion of G2D cases among newly diagnosed patients and the G2D rate in a population is an indicator of the efficiency of early case detection of leprosy. They also signifies the awareness levels of early clinical signs of leprosy, accessibility to leprosy services and skills of health workers in diagnosing leprosy.[1] The strategy is designed so as to achieve the long-term goal of a 'leprosy-free world", wherein the community is free of morbidity, disabilities and social consequences due to leprosy. Based on this rationale of improving early detection of leprosy to reduce transmission of the infection and by curbing the number of new G2D cases, the Global Leprosy Strategy aims at zero disabilities among newly diagnosed children by 2020.[1] This can be achieved by working towards the introduction of one type of treatment for all categories of leprosy for a shortened duration, targeting case detection activities in high-endemic areas, and focusing on screening of contacts. The target of zero disability in new cases among children has been introduced because it combines a target based on children with that of early detection and reduction in disability. This target also emphasizes the unacceptability of disability due to leprosy in children and will encourage community support for the programme. Each new paediatric patient with G2D should trigger an investigation into the reasons for the delay in detection and diagnosis, and the development of new approaches to avoid further recurrences. Hence the Global Leprosy Strategy for the next five years (2016–2020) will comprise the early detection of all patients before they develop deformities, prompt treatment with a uniform MDT regimen with shortened duration. They also include cases of MB and focuses on

research especially in the areas of prevention with newer diagnostic techniques. It also aims to reduce the stigma attached to the disease by promoting broader partnerships among stake holders.

The purpose of the study was to determine the frequency and the severity of the deformities and to correlate the sociodemographic factors associated with diabilities. In our study, out of 212 diagnosed leprosy subjects, deformities were seen in 62 cases, making the disability and deformity index of 29.2% which is similar to study conducted by Singhi et al,[10] but in contrast to the study conducted by farooq et al.[11] Out of these 62 cases of deformities, preponderance among male sex was noted in 43(69.4%) patients while female sex was 19(30.6%).

Thus deformities were more common in males with a male:female sex ratio of 7:3. This data was similar to studies conducted by Singhi et al,[10] and Croft et al[12] with male preponderance. The most common age group in our study in subjects with deformities was 41-50 years with 19(30.6%) cases which were similar to a study conducted by Singhi et al.[10] It was followed by the age group of 21-30 with 14(22.6%) cases and 31 – 40 years age group with 13 (20.9%) cases. Maximum number of affected males were in the age group of 31- 40 years with total of 11(17.7%)cases and 21-30 years with 11(17.7%) followed by 41-50 years with total of 10(16.1%) cases and 51 to 60 years with 5(8.06%) cases. Females were affected more in the age group of 41 to 50 years with a total of 9(14.5%) cases in this age group, followed by 51 to 60 years group with 4 (6.4%) cases which is similar to the studies conducted by singhi et al.[10] The study also showed that based on socioeconomic factors most of the subjects belonged to lower socioeconomic class with 26(41.9%) cases when compared to upper socioeconomic class with 17(27.4%) cases. The occupation of the participants in our study was mostly manual laborers like farmers and construction workers with 43(70.1%), followed by housewives with 10(16.1%) cases. Manual labor was more common occupation in case of males and housework in case of females which is similar to studies conducted by Krishnan et al.[13] The duration of the disease that has a direct implication on disability rate was highest in the disease with duration of 2 to 5 years 29(47%) cases followed by more than 5 years 18(29%) cases and the least deformities noted in 0-2 years duration group 15(24%) cases. It was similar to studies conducted by Richardus et al.[14]

The deformities were more commonly seen in lepromatous leprosy cases with total of 20(32%) followed by borderline lepromatous cases with total of 17(28%) and pure neuritic type of leprosy with 12(19%) cases. Subjects with least deformities were in the borderline tuberculoid spectrum of leprosy. This was similar to studies conducted by Jhuma sarkar et al[15] and Singhi et al.[10] The lower percentage of pure neuritic cases associated with disability was similar to the study done by Mahajan et al.[16] In our study multibacillary cases had more deformities 50(80.6%) cases when compared to paucibacillary 12 (19.35%) cases which is similar to studies conducted by Schreuder et al[17] and De Oliviera et al.[18] Anaesthetic type of deformities was most common with total of 44(82.26%) subjects followed by specific type of deformities in 22(35.48%)subjects and paralytic type of deformities in 20(32.25%) cases. This was similar to the studies conducted by Atul Shah et al.[20] Anaesthetic type of deformities was seen more in lepromatous type of leprosy and paralytic type of deformities was noted more in pure neuritic type of Hansen(42%). It was similar to study conducted by kumar et al.[19] Other deformities noted were face 7(11.29%) cases, eyes 5(8.06%) cases and ears 5(8.06%)cases with lesser involvement which was very similar to the studies conducted by Atul Shah et al.[20] Sensory loss 25(40.32%) cases was more commonly noted followed by numbness 14(22.58%) subjects in the case of anaesthetic deformities involving the hand. Weakness 11(17.74%) cases was most common paralytic deformity noted in case of hand deformities.It was similar to the studies conducted by Jhuma Sarkar et al.[15] Numbness 14(22.58%) cases was followed by glove and stocking type of Anesthesia 12(19.35%) cases were commonly noted anesthetic deformity involving the foot. Foot drop (8.06%) was most common paralytic deformity similar to the study by Jhuma Sarkar et al.[15] Madarosis (8.24%) was the most common deformity in case of eyes which is similar to the study conducted by farooq et al.[10]

Conclusion

The study shows that deformities and disabilities occurred due to delay in early case detection of grade -1 disablity, lack of treatment assess and health education. Training the health care workers on diagnosing nerve thickening and nerve function impairment will prevent the progression of grade 1 disability to visible grade 2 disability thereby reducing the number of new leprosy cases with Grade 2 disability to less than one case per million population. Based on this rationale of improving early detection of leprosy to reduce transmission of the infection and by curbing the number of new G2D cases, the Global Leprosy Strategy 2016–2020 aims to achieve the long-term goal of a 'leprosy-free world", wherein the community is free of morbidity, disabilities and social consequences due to leprosy.

Conflict of Interest: None.

References

1. The current Global Leprosy strategy 2016 – 2020 'Accelerating towards a leprosy free world'. Available from :http://www.searo.who.int/entity/global_leprosy_programme/documents/global_leprosy_strategy_2020/en
2. Withington SG, Joha S, Baird D, Brink M, Brink J. Assessing socio‐economic factors in relation to stigmatization, impairment status and selection for socio‐economic rehabilitation: A 1 year cohort of new leprosy cases in North Bangladesh. *Lepr Rev* 2003;74:120‐132.
3. Park K. Park's Textbook of Preventive and Social Medicine. 24th ed. Jabalpur: M/s Bhanot Publishers; 2017;332‐347.

4. Albert CJ, Smith WC, Meima A, Wang L, Richardus JH. Potential effect of the World Health Organization's 2011‐2015 global leprosy strategy on the prevalence of grade 2 disability: A trend analysis. *Bull World Health Organ* 2011;89:487‐495.
5. DGHS. Ministry of Health and Family Welfare, Nirman Bhawan, New Delhi. NLEP. Training Manual for Medical Officers, 2009. Available from: http://www.whoindia.org/LinkFiles/Leprosy_Leprosy_Manual.pdf.
6. Jacob M, Mathai R. Purely neuritic leprosy. *Int J Lepr Other Mycobact Dis* 1988;56:56‐60.
7. Brandsma JW, van Brakel WH. WHO disability grading: Operational definitions. Lepr Rev 2003;74:366‐373.
8. Van Brakel WH, Anderson AM, Withington SG, Croft RP, Nicholls PG, Richardus JH, *et al*. The prognostic importance of detecting mild sensory impairment in leprosy: A randomized control trial (TRIPOD 2). *Lepr Rev* 2003;74:300‐310.
9. Owen BM, Stratford CJ. Assessment of the methods available for testing sensation in leprosy patients in rural setting. *Lepr Rev* 1995;66:55‐62.
10. Singhi M,Ghiya, Dhruv Gupta.Disability rates in leprosy. *Indian J Dermatol Venereol Leprol* 2004;70:115-117.
11. Farooq Rahman Soomro, Ghulam Murtaza Pathan, Parvez Abbasi, Nuzhat Seema Bhatti.Ocular disabilities in leprosy, Larkana district, sindh, pakistan.*J Pak Assoc Dermatologists* 2007;17:11-13.
12. Croft RP, Richardus JH, Nicholls PG, Smith WC. Nerve function impairment in leprosy: Design, methodology and intake status of a prospective cohort study of 2664 new leprosy cases in Bangladesh. The Bangladesh Acute Nerve Damage Study. *Lepr Rev* 1999;70:140‐159.
13. Krishnan SK, Gokarn A. Study of leprosy among slum dwellers in Pune, Part II Disabilities. Indian J Public Health1992;36:87‐92.
14. Richardus JH, Finlay KM, Croft RP, Smith WC. Nerve function impairment in leprosy at diagnosis and at completion of MDT:A retrospective cohort study of 786 patients in Bangladesh. *Lepr Rev* 1996;67:297‐305.
15. Jhuma Sarkar, Aparajita Dasgupta, Debashis Dutt. Disability among new leprosy patients, an issue of concern: An institution based study in an endemic district for leprosy in the state of west bengal, India.
16. Mahajan PM, Jogaikar DG, Mehta JM. A study of pure neuritic leprosy -clinical experience. *Indian J Lepr* 996;68:137‐141.
17. Schreuder PA. The occurrence of reactions and impairments in leprosy: Experience in the leprosy control program of three provinces in northeastern Thailand, 1987‐1995 [correction of 1978‐1995]. III. Neural and other impairments. *Int J Lepr Other Mycobact Dis* 1998;66:170‐181.
18. De Oliveira CR, De Alencar Mde J, De Sena Neto SA, Lehman LF, Schreuder PA. Impairments and Hansen's disease control in Rondonia State, Amazon region of Brazil. *Lepr Rev* 2003;74:337‐348.
19. 19.Kumar A, Girdhar A, Girdhar BK. Nerve thickening in leprosy patients and risk of paralytic deformities: A field based study in Agra, India. *Lepr Rev* 2004;75:135‐142.
20. Atul Shah, Neela Shah. Deformities of face, Hands and Feet, and their Management. Hemanth kumar kar, bhushan kumar editors. IAL Text book of Leprosy. Jaybee publications. 1st ED. 2010:439-441.

How to cite this article: Daniel SJ, Kumar RS, Babu RA, A prospective observational study of deformities in leprosy in tertiary care center in South. *Indian J Clin Exp Dermatol* 2019;5(1):61-67