Trend and Clinico-Epidemiological Pattern of Leprosy Cases in a Tertiary Care Center of North Kerala

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ABSTRACT

Background: Leprosy produces different manifestations based on the body's immune reaction to the Mycobacterium Leprae bacilli The disease continues to be an important public health problem even after India declared Leprosy eliminated in 2005, with around 60% cases being reported from India globally. The objective of this study was to study the trend and clinico-epidemiological pattern of leprosy cases attending the tertiary care center of North Kerala, India.

Methods: A record-based cross-sectional study was carried out at the tertiary care referral centre of Kozhikode district for a period of 6 months from January 2021 to June 2021. Data were collected during the previous 5 years, from January 2014 to December 2018, which included 328 confirmed Leprosy cases.

Results: The study included 328 confirmed leprosy cases, of whom 230 (70.1%) were males and 98 (22.9%) were females. The cases showed an upward trend, followed by a gradual decline. The age distribution indicated a shift toward older age groups during the period from 2014 to 2018. 14% of cases were migrants. Despite symptoms, there was delay in seeking medical care in 30.2% cases. Multibacillary cases were the predominant type of leprosy. Moreover, male gender, older age group and migrants showed significant association with multibacillary leprosy.

Conclusion: The initial study period showed an upward trend in leprosy cases followed by a gradual decline. The study revealed predominance of multibacillary leprosy, especially among males, older age groups, and migrant populations, indicating the importance of targeted screening, early diagnosis, and treatment for high-risk populations to stop transmission and improve leprosy control.

Keywords: Leprosy; Epidemiology; Immigrants; Tertiary care centre; Kerala

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Introduction

Leprosy, caused by Mycobacterium leprae, differs from most other bacterial infections. Disease largely remains asymptomatic till late stages. The slowly multiplying organism manages to evade the immune system of the host by its intracellular location and by not producing any toxins (1).

The clinical manifestations of leprosy are determined mainly based on the body's immune reaction to the bacilli. Those with good immunity can resist the disease, whereas those with the least immunity develop the lepromatous disease. The cases who show varying immunity to the organism manifest characteristics of different borderline groups. Moreover, leprosy reactions which are the acute exacerbations in the otherwise chronic disease, are produced by the body's immune response to the breaking down bacilli (4). The immune system of the body acts differently in extremes of age and in different genders. The clinical presentation may also depend on genetic factors and may differ among population groups. Children usually exhibit a lower frequency of severe complications and reactions, probably due to immune system maturation differences and shorter duration of disease exposure (5).

Leprosy remains asymptomatic during its early stages, leading to delayed diagnosis and continued transmission within the community (1). A prevalence of less than 1 per 10,000 cases is considered as eliminated, and India achieved leprosy elimination by December 2005. India still has the highest leprosy burden in the world, contributing to 58% of the new cases, followed by Brazil (6). The National Strategic Plan and Roadmap for Leprosy (2023-2027) aligned with Global Leprosy Strategy 2021-2030 envisions a Leprosy free India (7). Previous studies showed a higher incidence of leprosy in males, but a higher incidence of leprosy reactions in females (8). Though several studies have described the epidemiological and clinical profile of leprosy in different regions of India, data from North Kerala remain limited. This dearth of region-specific data represents an important knowledge gap which may hinder effective planning and implementation of regional leprosy control strategies. Hence, the present study was undertaken to analyze the trends and clinico-epidemiological characteristics of leprosy patients attending a tertiary care centre in Kozhikode district, North Kerala.

Methods

This record based cross-sectional study was conducted in the dermatology department of a tertiary referral center for a period of 6 months from January 2021 to June 2021. The study population included the patients attending the tertiary care center in Kozhikode district during 5 years, from January 2014 to December 2018. The inclusion criterion was patients diagnosed with Hansen's disease based on World health Organisation cardinal criteria (9). Case records of patients with insufficient data were excluded. The data were collected from the cases records using pretested semi-structured questionnaire. Universal sampling method was also used. The sample included 328 confirmed leprosy cases. The study was initiated after obtaining clearance from institutional research and ethics committees.

The authors collected information on the year of presentation, age, gender, occupation, socioeconomic status and current and permanent residence of the study participants using a proforma. The time interval between the initial manifestation of the disease (as noted by the patient or a healthcare worker) and the diagnosis was recorded. The authors collected data regarding the duration and evolution of the disease, history of receiving treatment for leprosy, family history, clinical features and laboratory investigations from previous case records. As per institutional protocol, all the patients who satisfy the diagnostic criteria for leprosy undergo skin smear studies (one from the ear lobe, one from a representative skin lesion and one from normal looking skin) for acid-fast bacilli and histopathology analysis of the representative skin lesion. The authors graded disability due to leprosy at the time of diagnosis as per World Health Organisation criteria (9).

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The details regarding the group of diseases were recorded in the spectrum of leprosy (based on clinical, skin smear and histopathology findings), treatment received and type of Lepra reactions. Whenever a patient in the borderline spectrum of leprosy featured an acute onset of erythema and oedema of skin lesions with or without neuritis and oedema of the hands, feet and face, a clinical diagnosis of type 1 Lepra reaction (T1R) was made. Crops of tender subcutaneous skin lesions with or without accompanying neuritis, iritis, arthritis, orchitis, dactylitis, lymphadenopathy, oedema and fever in a borderline lepromatous or lepromatous Leprosy patient were considered as type 2 Lepra reaction (T2R) (10).

The data were entered into Microsoft Excel and analyzed with SPSS version 18. Quantitative data were analyzed by mean and standard deviation. Furthermore, qualitative data were analyzed by proportions. The association of the type of leprosy with sociodemographic factors were assessed by Pearson's chi-square test. The difference in age between the multibacillary and paucibacillary groups was also analyzed using an independent-samples t-test. P -value of less than 0.05 was considered significant.

Results

A total of 328 new leprosy cases were registered in the department of Dermatology, Venereology and Leprosy during the period of 2014 to 2018. Epidemiological characteristics of the leprosy cases are summarized in Table 1. The age of the study participants ranged from 5 to 78 years, with a mean age of 37.55 ± 15.8 years, with a minimum of 5 years to a maximum of 80 years. The most common age group affected was 30 - 44 (105/328, 32%), followed by 15-29 (104/328, 31.7%). There were 230 (70.1%) males and 98(29.9%) females with a male to female ratio of 2.35:1. Moreover, out of the 328 patients, 46(14%) were migrants.

Table 1. Epidemiological characteristics of the leprosy cases of leprosy cases (n = 328)

Variable	Category	Frequency (n = 328)	Percentage
Age (Years)	< 15	21	6.4%
	15-29	104	31.7%
	30- 44	105	32.0%
	45- 59	72	22.0%
	>/= 60	26	7.9%
Gender	Male	230	70.1%
	Female	98	29.9%
Area of Residence	Native of Kerala	282	86.0%
	Migrant (outside Kerala)	46	14.0%

Trend of leprosy cases in a Tertiary care Center, 2014- 2018.

From 2014 to 2016, the total case detection at the center showed an upward trend, followed by a gradual decline from 73 to 62 cases. The age distribution indicated a shift toward older age groups during the period from 2014 to 2018. Details of the trend are shown in Table 2. In addition, multibacillary cases were the predominant type of leprosy throughout the study period (Figure 1).

Table 2. Epidemiological trend of leprosy cases in a tertiary care center

Year	Total no. of cases (n)	Mean age (Yrs ± SD)	Males/females, n (%)	Migrants, n (%)
2014	68	32.87 ± 16.6	48(70.6)/ 20(29.4)	10 (14.7)
2015	73	36.86 ± 15.0	51(69.9)/ 22(30.1)	7 (9.6)
2016	70	40.91 ± 15.6	50(71.4)/ 20(28.6)	12 (17.1)
2017	55	35.27 ± 14.7	36(65.5)/ 19(34.5)	7 (12.7)
2018	62	39.82 ± 16.1	45(72.6)/ 17(27.4)	10 (16.1)

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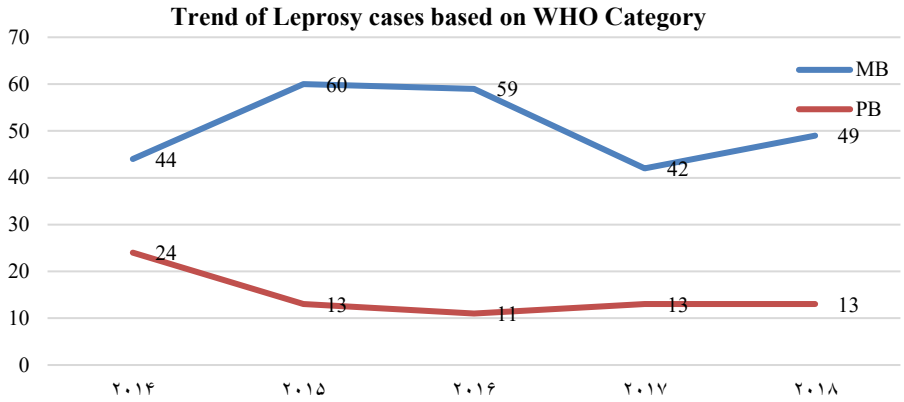


Figure 1. Clinical trend of leprosy cases in a Tertiary Care Center, 2014- 2018

Clinical pattern of leprosy cases,2014-2018

The clinical pattern of leprosy cases is shown in Table 3. Among the total 328 cases, 48(14.6%) cases were presented without any skin lesions (pure neuritic type). 177 cases (53.9%) were presented with five or fewer skin lesions, and 103(31.5%) cases had more than 5 skin lesions. Cutaneous manifestations (298,88%) were the predominant initial symptom, and the initial presentations of leprosy cases are shown in Figure 2. The majority (205, 62.6%) of the leprosy cases belonged to the Borderline Tuberculoid (BT) (205, 62.6%) spectrum. Out of the total cases, 254(77.4%) were multibacillary leprosy cases. At the time of diagnosis, 175(53.4%) had no disability, 40 cases (12.2%) showed grade 1 disability and 113(34.4%) cases showed grade 2 disability. Leprosy reactions were observed in 234(71.3%) of cases.

Despite having symptoms, there was a delay of more than 24 months in 99(30.2%) cases in seeking medical care. A total of 120 (36.6%) cases were presented to the outpatient clinic within 6 months of the onset of the first symptom. 31 cases (9.5%) gave a history of leprosy in the past, and 10 cases (3.1%) had a history of leprosy among the family members. (Table 3)

Among the 328 cases, 2 (0.6%) cases were HIV positive and were on combined antiretroviral therapy for one year at the time of diagnosis of leprosy. Of these 2 cases, one male patient was HBsAg positive. Another male patient had scrofuloderma coexisting with leprosy. Both male patients were presented with Type 1 Lepra reaction. All the three patients were given multidrug treatment and successfully completed treatment.

Table 3. Clinical pattern of leprosy cases, 2014-2018.

Variable	Category	Frequency	Percentage
Time interval between first symptom and diagnosis	< 6 months	120	36.6
	6months – 12months	46	14.0
	13 months- 24 months	63	19.2
	> 24months	99	30.2
Past history of leprosy	Yes	31	9.5
	No	297	90.5
Family history of leprosy	Yes	10	3.1%
	No	318	96.9%
No. of skin lesions	No skin lesion	48	14.6
	≤ 5 skin lesions	177	53.9

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Variable	Category	Frequency	Percentage
	> 5 skin lesions	103	31.5
Clinical spectrum of Leprosy based on Indian classification*	HD (I)	5	1.5
	HD (N)	51	15.5
	TT	8	2.4
	BT	205	62.6
	BB	4	1.2
	BL	29	8.9
	LL	26	7.9
WHO classification	PB	74	22.6
	MB	254	77.4
WHO disability grading at initial presentation	No disability	175	53.4
	Grade 1	40	12.2
	Grade 2	113	34.4
Leprosy reactions	No	94	28.7
	Yes	234	71.3

*Indian classification: HD (I): indeterminate leprosy; HD (N): pure neuritic leprosy; TT: tuberculoid leprosy; BT: borderline tuberculoid leprosy; BB: mid borderline leprosy; BL: borderline lerpomatous leprosy; LL: lepromatous leprosy

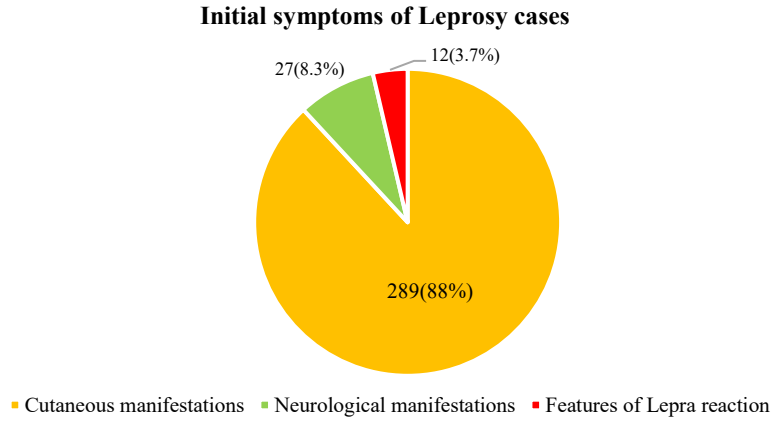


Figure 2. Initial symptoms of leprosy cases

Clinical characteristics of Relapse in patients.

31 (9.5%) patients had a previous history of treatment for leprosy, and the details are shown in Table 4. Of the 31 relapsed cases, 4 (12.9%) patients had no documented evidence of the spectrum of leprosy and the treatment received. Among the 31 patients who had a relapse of leprosy, 23 (74.2%) were males and 8 (25.8%) were females (Table 4). The time interval between the previous and the current treatment ranged from 9 months to 28 years, with a mean time of 7.9±7.7 years. 6 out of 31 patients (19.4%) were non-compliant with previous treatment and were defaulted. All the defaulters manifested lesions representative of the same group of the spectrum.

Among the relapse cases, 21 patients (67.7%) had documented evidence of receiving adequate treatment in the past. 16 (76.2%) out of the 21 patients who had received adequate treatment for leprosy in the past manifested lesions representative of the same group in the spectrum. 5 patients (5/21, 23.8%) who had received adequate treatment relapsed in different leprosy spectra. 2 patients were initially diagnosed as pure neuritic cases relapsed with BT lesions, while three BT patients relapsed with pure neuritic leprosy, borderline leprosy and lepromatous leprosy.

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Table 4. Clinical characteristics of relapsed leprosy cases (n = 31, 9%)

Variable	Category	Frequency	Percentage
Gender	Male	23	74.2
	Female	8	25.8
Documentation	Present	27	87.1
	Absent	4	12.9
Clinical spectrum of leprosy in the past(n=27)	PB	24	88.9
	MB	3	11.1
Self-reported compliance to previous treatment	Complaint	25	80.6
	Non complaint	6	19.4
Previous spectrum of disease(n=21)	Same as present spectrum	16	26.2
	Different from present spectrum	5	23.8
Previous treatment status	Completed	21	67.7
	Defaulted	6	19.4
	Unknown	4	12.9

Factors associated with Multibacillary Leprosy Vs Paucibacillary Leprosy.

It was found that MB leprosy cases consistently outnumbered PB cases across various demographic and clinical parameters. The mean age of patients with MB leprosy was significantly higher (38.8 ± 15.3 years) compared to those with PB leprosy (31.47 ± 16.2 years), with a p-value of 0.001. A higher proportion of males were presented with MB leprosy (185; 80.4%) compared to females, 69 (70.4%) (p = 0.047). Migrant population (44, 95.7%) also showed a strong association with multibacillary cases of leprosy compared to natives of Kerala (210,74.5%) (p = 0.001). Regarding annual trends in diagnosis, MB cases remained predominant throughout all years from 2014 to 2018. The proportion of MB cases ranged from 64.7% in 2014 to 84.3% in 2016, followed by slight declines in the later years. However, the association was not statistically significant (p = 0.055). Details of factors associated with MB leprosy are shown in Table 5.

Table 5. Factors associated with MB leprosy Vs PB leprosy

	Category	MB leprosy	PB leprosy	P value
Age	Mean age ± SD	38.8 ± 15.3	31.47 ± 16.2	0.001
Gender	Male	185(80.4%)	45(19.6%)	0.047
	Female	69 (70.4%)	29(29.6%)	
Residence	Migrant	44(95.7%)	2(4.3%)	0.001
	Native of Kerala	210(74.5%)	72(25.5%)	
Year of diagnosis	2014	44(64.7%)	24(35.3%)	0.055
	2015	60(82.2%)	13(17.8%)	
	2016	59(84.3%)	11(15.7%)	
	2017	42(76.4%)	13(23.6%)	
	2018	49(79%)	13(21%)	

Discussion

Over the five years from 2014 to 2018, a total of 328 new leprosy cases were registered in the department of dermatology of a tertiary referral center in North Kerala. The demographic profile of the patients sheds light on the ongoing epidemiological trends of leprosy in this region. The mean age was 37.55 ± 15.8 years, with cases ranging from as young as 5 years to a maximum of 80 years, indicating that leprosy continues to affect a wide age spectrum. The highest burden was observed among individuals aged 30–44 years

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(32%), closely followed by the 15–29 years age group (31.7%), highlighting that the economically productive age groups remain the most affected. This finding reflects a younger age distribution compared to the study conducted by Queirós et al. (11), which might be due to regional variation in the age pattern of leprosy presentation. The study observed a clear male predominance, with a male-to-female ratio of 2.35:1. The male predilection for leprosy noted by the authors was consistent with the literature and falls in the ratio (1.8:1 and 3:1) reported by previous authors (8,12,13). Migrant population contributed to 14% of the total cases in this study, which was lower than the study conducted in Gujarat (14), emphasizing the role of population mobility in leprosy transmission.

An analysis of the year-wise distribution of leprosy cases from 2014 to 2018 revealed variations in demographic patterns over time and is consistent with other studies (15). The mean age of patients showed a gradual increase over the study period, indicating a possible age shift towards older populations. This trend may be due to delayed diagnosis among older patients. Throughout the study period, there was a consistent male predominance, with males accounting for approximately 65% to 73% of cases annually. This aligns with existing literature, which frequently reports a higher incidence of leprosy in males (15), possibly due to increased occupational exposure, behavioural factors, or differences in healthcare-seeking patterns between genders. The proportion of migrant patients fluctuated between 9.6% and 17.1%, with the highest percentage seen in 2016. Migrant populations are often more vulnerable to delayed diagnosis due to limited access to healthcare, language barriers, and a lack of disease awareness (16). This finding stresses the importance of active case detection campaigns and leprosy surveillance programs among the migrant population.

A wide variation in clinical presentation was evident. 14.6% of patients were presented without any visible skin lesions, which complicates clinical suspicion and diagnosis, especially in primary care settings. This finding was very high compared to the study by Queiros et al (11). Among those with lesions, a majority (53.9%) had five or fewer problems, which is comparable with a study conducted in Gujarat (14). In the current study, borderline tuberculoid (BT) leprosy was the most frequent clinical subtype (62.6%), followed by borderline lepromatous (8.9%) and lepromatous leprosy (7.9%). The dominance of BT leprosy reflects an intermediate immune response. In contrast to this study, a study conducted in South Rajasthan reported a higher prevalence (43.9%) of lepromatous leprosy cases (15). The high proportion of MB cases seen in this study is consistent with the findings noted in the study conducted in South Rajasthan (15).

One of the most important findings is that 34.4% of patients were presented with grade 2 disability at diagnosis. This is comparable with the study by Masatkar et al. (14), which is an indicator of both diagnostic delay and insufficient community awareness. Grade 2 disability represents visible deformity or functional impairment, which contributes to stigma, exclusion, and socioeconomic hardship for affected individuals. A concerning observation in the study was the delay in diagnosis, with only 36.6% of patients diagnosed within six months of the symptom onset. About 30.2% had delays exceeding 24 months. This delay in seeking or receiving a diagnosis contributes significantly to disease progression and deformities, increased transmission, and a higher risk of disabilities. These findings highlight the need for increased awareness at the community and primary healthcare levels to promote early case detection and intervention.

In the present study, 9.5% of patients had a past history of leprosy, indicating possible disease relapse or reactivation. This relapse rate is clinically significant and raises concerns regarding the effectiveness of previous treatment regimens, treatment adherence, or reinfection. Among the 31 cases with a past history of leprosy, 6 (19.4%) patients were defaulters, which is comparable with previous studies (15). This highlights the crucial role of treatment compliance in the management of leprosy.

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In the present study, male gender, older age group, and migrant status were found to be significantly associated with MB leprosy**.** Male predominance among MB cases may be attributed to increased occupational exposure, delayed health-seeking behavior, and potentially lower access to healthcare among men in certain socioeconomic groups. Similarly, the higher prevalence of MB leprosy in older individuals likely reflects delayed diagnosis and prolonged disease duration, allowing progression from paucibacillary to multibacillary forms. Migrant populations also showed a significantly higher proportion of MB cases. This may be due to a lack of disease awareness, language barriers and poor health-seeking behavior, all of which contribute to delayed detection and advanced disease at presentation. These findings are consistent with a study conducted in West Bengal (15). These findings reinforce the importance of targeted surveillance, early detection strategies, and improved access to leprosy services, especially among working-age adults and vulnerable populations such as migrants.

Sustained efforts in public awareness and stigma reduction by continuous health education activities through involving field workers and community health volunteers are also essential to facilitate early health-seeking behavior and interrupt transmission chains. Moreover, leprosy day activities should be observed at the school level to enhance awareness about the disease. Awareness needs to be strengthened through television and other visual communication media to promote the early identification of symptoms. Ultimately, strategies to improve treatment adherence should be incorporated into the National Leprosy Eradication Program.

Limitations

This study was conducted at a tertiary care center as a single-center study, which may not be representative of the community burden, and most of the cases might be reported late in the advanced stage. Larger community-based studies over a longer duration are required to assess the trend and epidemiological pattern of leprosy in the community.

Conclusion

Leprosy continues to be an important public health concern in our society. The year-wise data from 2014 to 2018 revealed variations in demographic patterns over time. There was a shift towards the older age group male predominance and increased prevalence in the migrant population over time; these factors were found to be significantly associated with MB leprosy. This finding highlights the importance of active case detection campaigns and targeted leprosy surveillance programs among the high-risk population. A concerning observation is that more than two-thirds of the cases had a delay in diagnosis, and around 1/3rd of the cases were presented with grade 2 disability at the time of diagnosis. This pinpoints the need for early detection and awareness generation among the vulnerable population**.**

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Conflict of interest

The authors declared no conflict of interest.

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Ethical considerations

All the ethical principles have been adhered to the present study. The study protocol was approved by the Institutional Research and Ethics Committees of Govt. Medical College, Kozhikode.

Code of ethics

The code was maintained during entire study period. (Ref No. GMCKKD/RP 2020/IEC/554)

Authors' contribution

All authors contributed to the conception, design, and definition of the intellectual content of the study; data were also collected by J. P, F. O, S.

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D and S. S; all authors participated in data analysis, interpretation, and manuscript drafting, and critical revisions. The final draft of the manuscript was reviewed and approved by all authors.

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