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Original Article

A Five -Year Retrospective Analysis of Clinico-epidemiological Pattern of Leprosy in a Coastal District of South India

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Leprosy emerges as a significant public health concern, undergoing potential shift in clinical and epidemiological characteristics amid the COVID-19 pandemic. The study analyses five years of clinico-epidemiologic and demographic data of leprosy cases obtained from the District Leprosy Office in Mangalore. It seeks to assess the impact of the COVID-19 pandemic on leprosy in Dakshina Kannada district, Karnataka, India. This is a retrospective study of 252 leprosy cases reported and treated in this district in the duration of 5 years (2018-2022). The results showed that the number of leprosy cases had decreased from 2018 to 2020, however, rising trend was seen in 2021 and 2022. A sudden decline in the prevalence rate to 0.12 and then increase to 0.32 per 10,000 population in 2020-21 and 2021-22, respectively was observed. Paucibacillary (PB) cases constituted 9.9%, while multibacillary (MB) cases were 90.1%. Childhood leprosy cases were 7.27% in 2019-20 , zero in 2020-21 and again increased to 4.4% in 2021-22. Grade 2 disability rates fluctuated from 9.5% in 2019-20 to 11.1% in 2021-22. Leprosy reactions were present in 24%, primarily Type 1. Statistical significance ($p < 0.05$) indicated an association between morbidity and leprosy type. The surge in multibacillary, childhood, and disability cases implies ongoing active transmission of leprosy. The study demonstrates how COVID-19 has caused am impacted on detection, treatment, and surveillance of leprosy in a coastal district of South India. Therefore, emphasizing the urgency to enhance surveillance and address potential cases overlooked during the pandemic.

Keywords: Leprosy, COVID-19, Epidemiology, Multibacillary, Coastal District, South India

Introduction

Leprosy (Hansen's disease), a communicable disease was the first infectious disease to have its etiological agent discovered, however it remains a disease of public health concern because of case load and social stigma attached to the disease (Bhat & Chaitra 2013). Hansen's disease was eliminated from India in terms of statistical prevalence (PR-1 case / 10,000 population) achieved at National level in 2005 (NLEP Annual Report 2021-22). However, India accounts for almost 60% of new cases reported globally each year.

During the reporting year 2018, 208,619 new leprosy cases were detected globally, and the new case detection rate was 2.74 per 100,000 population. In 2018, data were received from all 23 global priority countries and new cases

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reported were 199,400. South-East Asia Region (SEAR) reported fewer cases 3.2% than in 2017, mainly due to a reduction in the number of new cases reported by India. The number of new case detection in India reduced from 133,717 to 120,334 from the year 2009 to 2018 (WHO 2018- Global Leprosy Update 2018).

In 2019, just over 200,000 cases (202,256 equating to 26 per million population) of leprosy were detected from 118 countries globally. Of them, 96% were reported by the 23 global priority countries, including 79% in India, Brazil and Indonesia. Around 5% of cases had visible deformities at the time of diagnosis, equating to 1.4 per million population . Globally, the new child case detection rate was 7.9 per million children. WHO has targeted zero leprosy by 2023 (WHO 2017- Towards Zero Leprosy Global Leprosy Strategy 2021-2030) which means zero child cases. India aims to achieve the same by 2027 (NLEP- NSP 2023).

The Government of India imposed a nationwide lockdown on 25 March 2020 as a preventive measure against the COVID-19 pandemic, which was later extended in phases until 31 May 2020. Coronavirus disease 2019 (COVID-19) affected leprosy programs in most countries (Anand et al 2020). The registered prevalence of leprosy (the number of cases on treatment at the end of 2020) was 129,192, with a rate of 16.6 per million population. Globally, 127,396 new cases were reported. Both figures were much lower than in previous years, with a 27.7% reduction in registered prevalence and a 37.1% reduction in new cases as compared with 2019. This change is probably due to less detection and reporting during the COVID19 pandemic. Data from all 23 global priority countries were received for 2020. The proportion of new cases in many countries was significantly lower than in 2019 (average, 31.1%), which may reflect the impact of the COVID-19 pandemic. In 2020, India reported 43.1% fewer cases than in 2019 (WHO 2021- Global Leprosy Update 2020).

In 2021, 143 countries provided statistics, as compared with 127 in 2020. During 2021, 140,594 new cases were reported globally. The rate of detection of new cases increased by 10.2% as compared with 2020. New cases accounted for 66.5% of cases in South-East Asia Region (SEAR). Brazil, India and Indonesia continued to report more than 10,000 new cases each. They accounted for 74.5% of the new leprosy cases detected worldwide in 2021.During 2021, rate of detection of new cases increased along with number of child cases (4.7%) when compared with 2020 (8642). Diagnosis of a patient from visible deformities (grade 2 disability, G2D) delays detection. The number of new G2D cases was higher in 2021 than in 2020 (7198). India reported an increase in the detection of new cases of leprosy to 75,394 in number in 2021 (WHO 2022- Global Leprosy Update 2021).

The number of new cases detected in Karnataka between Jan 2021 to Oct 2021 was 1482 and prevalence of leprosy being 0.20 (NLEP Annual Report 2021-22). As impact of Covid-19 disruptions and or infection may vary from area to area depending upon access, we need to analyse the trends region/ district wise.

The potential increase in unnoticed cases puts the patients' disability status at risk and contributes to the continuous transmission. A key factor attributed to the escalation in leprosy instances is the delay in diagnosing and management of the disease, coupled with reactions that result in persistent neuritis and subsequent deformities and disabilities. Hence, it is essential to scrutinize these changes and advocate for improved surveillance to maximize patient detection. The emergence of COVID-19 significantly impacted various aspects of life, and the National Leprosy Eradication Programme was not exempt from its consequences. Several articles highlight the

possible worsening of underreporting of leprosy cases nationwide during the pandemic.

In light of this background, the present study was conducted to determine the quantity and understand the characteristics of leprosy cases recorded between 2018 and 2022. Additionally, the study aimed to assess how the diagnosis of leprosy in the Dakshina Kannada District, Karnataka, was affected by the COVID-19 pandemic.

Materials and Methods

A retrospective record- based study was done in District Leprosy Office at Mangaluru, Dakshina Kannada, Karnataka, India after permission was taken from District Health Officer and District Leprosy Officer. All the new cases registered belonging to the Dakshina Kannada district with case record that fulfilled case definition of leprosy (WHO) and as used by our National Leprosy Eradication Programme (NLEP) from January 2018 to December 2022 were taken in study. This study was carried out after Ethical review board of KMC Mangalore (approval reference number : IECKMCMLR-11/2022/463).

The collected data was entered in Microsoft Excel and analysed using IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

Results

A total number of 252 cases were reported in Dakshina Kannada district for 5 years (2018-2022). The distribution of cases over a span of 5 years show that number of leprosy cases had decreased from 2018 to 2020, however, rising trend had been seen in 2021 and 2022 (35.7%) shown in Fig. 1. The prevalence rate has decreased, with a rate of 0.21 cases per 10,000 population in 2018-2019 to 0.15 cases per 10,000 population in 2019-20. A sudden decline in the prevalence rate to 0.12 and then increase to 0.32 per 10,000 population in 2020-21 and 2021-22, respective-

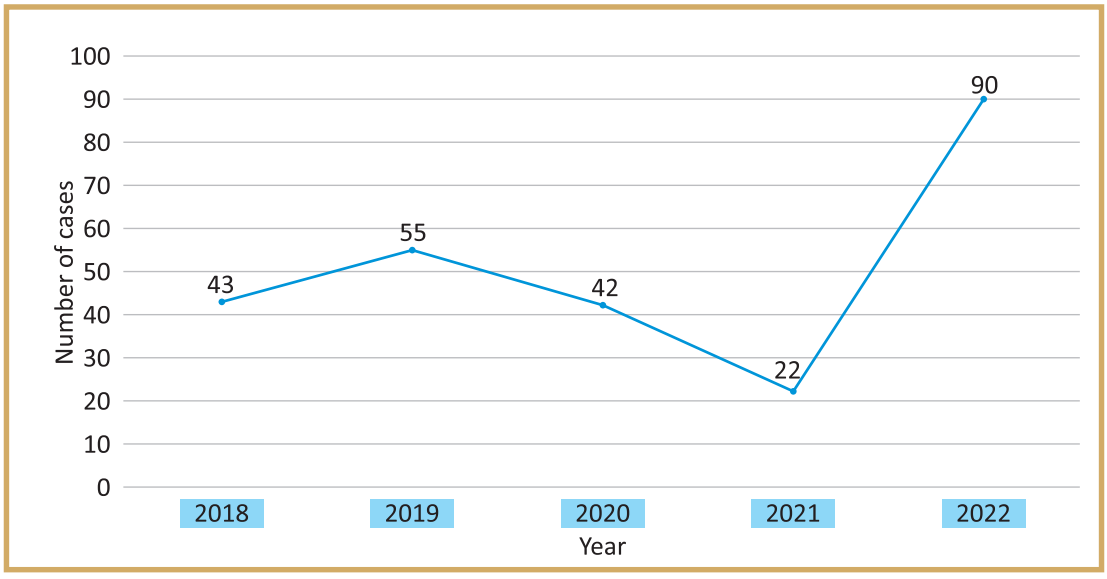

Fig. 1 : Number of leprosy cases reported in Dakshina Kannada district from 2018-2022.

ly was seen. Child case percentage among new cases detected being 7.27% in 2019-20, reduced to zero in 2020-21 and again increased to 4.4% in 2021-22. The percentage of Grade 2 Disability among new detected cases was 9.5% in 2019-20, declined to 4.5% in 2020-21, and subsequently rose to 11.1% in 2021-22.

Majority (70%, n=177) of the cases in Dakshina Kannada district were males. The mean age among study cases was 39 ± 15 years. The general information about the study population is shown in Table 1.

Table 1 : General information of study population.

	Frequency (n=252)	Percentage
Age (in years)		
<15	8	3.2
15-30	78	31.0
31-45	79	31.3
46-60	67	26.6
>60	20	7.9
Gender		
Female	75	29.8
Male	177	70.2
Place of residence		
Dakshina Kannada	166	65.9
Other district	28	11.1
Other state	57	22.6
Other country	1	0.4

Table 2 : Biopsy proven diagnosis in study population.

Biopsy diagnosis	Frequency	Percentage
Tuberculoid leprosy	24	16.6
Borderline tuberculoid	48	33.1
Borderline borderline	6	4.1
Borderline lepromatous	28	19.3
Lepromatous Leprosy	21	14.5
Histoid leprosy	4	2.8
Indeterminate leprosy	5	3.4
Pure neuritic leprosy	9	6.2
Total	**145**	**100**

Table 3 : Slit Skin Smear (BI Index) reports of study population.

Slit Skin Smear report (BI Index)	Frequency	Percentage
1+	6	10.2
2+	3	5.1
3+	2	3.4
4+	12	20.3
5+	18	30.5
6+	18	30.5
Total	**59**	**100**

Table 4 : Factors associated (age group, gender and morbidity) with type of leprosy (according to WHO classification).

	Type of leprosy		Test statistics	P value
	MB	**PB**		
Age				
<15	6(75.0)	2(25.0)	2.215##	0.699
15-30	70(89.70)	8(10.3)		
31-45	72(91.1)	7(8.9)		
46-60	61(91.0)	6(9.0)		
>60	18(90.0)	2(10.0)		
Gender				
Female	66(88.0)	9(12.0)	0.517##	0.472
Male	161(9.0)	16(9.0)		
Morbidity				
Present	97(98.0)	2(2.0)	11.4#	0.0001*
Absent	130(85.0)	23(15.0)		
Disability				
Present	71(98.6)	1(1.4)	8.21#	0.002*
Absent	156(86.7)	24(13.3)		
Disability grade				
Grade 1	52(98.1)	1(1.9)	-	-
Grade 2	19(100.00)	0		
Lepra reaction				
Present	59(98.3)	1(1.7)	6.00#	0.012*
Absent	168(87.5)	24(12.5)		
Type of Lepra reaction				
Type 1	35(97.2)	1(2.8)	-	-
Type 2	24(100.0)	0		

Statistical test used: #Fishers exact test; ##Chi square test. *p value <0.05 is considered statistically significant

Paucibacillary status was seen in 9.9% (n=25) of the cases and multibacillary in 90.1% (n=227) of the cases. 145/252 (33.1%) patients were biopsy proven borderline tuberculoid followed by 19.3% of borderline lepromatous leprosy as shown in Table 2. This data also shows that majority of cases in this subset also appear to belong to multi-bacillary types if classified according to WHO/NLEP classification of paucibacillary (PB)/ multibacillary (MB) leprosy.

Disability was present in 29% with majority being Grade 1. Lepra reaction was present in 24% with Type 1 being predominant.

Positive slit skin smear for acid-fast bacilli (AFB) was seen in 120 patients with bacteriological index (BI) 5+ and 6+ in 31% of 59 individuals in which bacteriological index was reported as shown in Table 3.

Factors associated (age group, gender and morbidity) with type of leprosy (according to WHO classification) are shown in Table 4. The association between morbidity (disability and lepra reaction) and type of leprosy was found to be statistically significant ($p < 0.05$).

Discussion

The study provides information on 252 confirmed cases of leprosy registered in District Leprosy office, Dakshina Kannada district during these 5 years of 2018-2022. While prevalence is low compared to many other parts of India and is overall as per average for Karnataka, predominance of MB leprosy types is a matter of concern.

India successfully eradicated leprosy as a public health concern, defined by having fewer than 1 case per 10,000 people, on a national scale in December 2005. Since then, the prevalence rate has consistently decreased, with a national rate of 0.84 cases per 10,000 population in 2005-06, reducing to 0.66 in 2015-16, and further dropping to 0.57 in 2019-20. However, the COVID-19 pandemic disrupted case detection, resulting in a sudden decline in the prevalence rate to 0.40 and 0.45 per 10,000 population in 2020-21 and 2021-22, respectively (NLEP 2023-2027).

A total of 75,394 new cases were identified during the 2021-22 period, resulting in an Annual New Case Detection Rate (ANCDR) of 5.09 per 100,000 population. In 2005-06, the ANCDR was 14.27 per lakh population, but this figure decreased to 10.93 in 2009-10, further declining to 9.71 in 2015-16, and reaching 5.52 per lakh population in 2021-22. The impact of the COVID-19 pandemic is evident in a sudden drop in case detection, with the ANCDR decreasing from 8.13 in 2019-20 to 4.56 per lakh in 2020-21. However, there has been a subsequent upward trend, with the ANCDR rebounding to 5.52 per lakh population in 2021-22 which challenges the march towards leprosy free India (NLEP 2023 - NSP 2023-2027).

Child cases percentage among new cases detected has reduced to 5.76 % in 2020-21. Percentage of Grade 2 Disability among new cases detected has decreased to 2.48 % in 2020-21 (NLEP Annual Report 2021-22).

According to the Annual report 2021-22 of Department of Health & Family Welfare Ministry of Health & Family Welfare Government of India, the number of new cases detected in Karnataka between Jan 2021 to Oct 2021 is 1482 and prevalence of leprosy being 0.20 (NLEP Annual Report 2021-22). Our study also shows the prevalence rate has decreased, with a rate of 0.21 cases per 10,000 population in 2018-2019 to 0.15 cases per 10,000 population in 2019-20. Nevertheless, the detection of cases was interrupted by the COVID-19 pandemic, resulting in a sudden decline in the prevalence rate to 0.12 and then increase to 0.32 per 10,000 population in 2020-21 and 2021-22, respectively. Child case percentage among new cases detected being 7.27% in 2019-20 , reduced to zero in 2020-21 and again increased to 4.4% in 2021-22. The

percentage of Grade 2 Disability among new detected cases was 9.5% in 2019-20, it declined to 4.5% in 2020-21, and subsequently rose to 11.1% in 2021-22.

The pattern of cases in the Dakshina Kannada District closely mirrors the global, national, and state trends of Hansen's cases. The shift is likely a result of reduced detection and reporting during the COVID-19 pandemic. Throughout much of 2020 and early 2021, measures aimed at controlling the spread of SARS-CoV-2 restricted the public's access to healthcare services. Additionally, interim guidelines from the World Health Organization recommended the temporary suspension of various activities related to Neglected Tropical Diseases (NTDs), encompassing surveillance initiatives and community campaigns. The actions taken to mitigate the transmission of COVID-19, coupled with broader consequences on social, economic, and healthcare systems, impeded endeavors to manage and diagnose various diseases, placing a particular emphasis on neglected conditions like leprosy (Silva da Paz et al 2022).

The fear of transmission of Covid-19 hindered proactive searching, interrupted timely diagnosis and ongoing surveillance of leprosy and other diseases. The reallocation of resources to other services causing inaccessibility to regular treatment, coupled with the shutdown of all detection programs, resulted in delays in diagnosing and managing leprosy and its reactions. Such delays lead to persistent neuritis and subsequent deformities and disabilities (Rao 2021).

In comparison to a 10-year retrospective study on Hansen's disease patients conducted by Chaturvedi et al (2021), the average age of the cases in our study was similar, and the majority of cases were males. However, in our study paucibacillary status was seen in 9.9% (n=25) of the cases and multibacillary in 90.1% (n=227) of the cases which showed a clear change in the trend. Positive slit skin smear was seen in 120 patients with 5+ and 6+ in 31% individuals. Disability was present in 29% with majority being Grade 1. Lepra reaction was present in 24% with Type 1 being predominant. Morbidity profile was comparable in both the studies (Chaturvedi et al 2021).

The elevated prevalence of multibacillary disease and an increased occurrence of patients experiencing reactions and deformities, in comparison to national averages, raises apprehensions.

In the research conducted by Bhat & Chaitra (2013), it was noted that among the new cases seeking treatment in the outpatient department, the prevalence of multibacillary cases (54.35%) surpassed that of paucibacillary cases. The incidence of leprosy was higher in males than females. At the time of presentation, 16 individuals (34.78%) exhibited lepra reaction, with type 1 reaction being the most common (26.09%), compared to type 2 reaction (8.7%), aligning with our study's findings (Chaitra & Bhat 2013). While there is a gap of almost one decade, these similarities indicate that determinants of disease profile have not changed much in this area.

A retrospective study of leprosy scenario at a tertiary level hospital in Delhi (Chhabra et al 2015) suggested that despite notable advancements in leprosy elimination, loads in some of tertiary care hospitals did not change parallelly pointing to continued transmission in their catchment areas.

The increased incidence of multibacillary cases, positive slit skin smears, child cases and disabilities observed in our study highlights the possibility of ongoing transmission within the community. Identifying and utilizing clinic-epidemiological indicators from regional studies, like ours, will aid in devising preventive strategies and developing effective initiatives for control and elimination of leprosy. Since it is a retrospective study based on records, there is a possibility that certain data might have been missed. For example, positive slit skin smears were seen in 120 patients. However,

only 59 of the 120 patients had proper records of bacteriological index and the remaining were just marked positive in the case records of patients and there was no mention of the bacteriological index.

Our study thus shows as how COVID-19 has impacted the detection, treatment, and surveillance of leprosy in a coastal district of India. The fluctuating rates of new cases and prevalence observed in different regions, even after initial control measures, suggest that the struggle against this disease is by no means finished. Consequently, there is a concern regarding India's capability to attain its leprosy control objectives, emphasizing the imperative to strengthen surveillance and identify cases that might have been overlooked during the pandemic. Equally crucial is the need for healthcare professionals to devise strategies for providing effective guidance and monitoring patients during and after treatment.

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